STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

DATE: November 19, 2019

FROM: Andrew O'Sullivan
Wetlands Program Manager

AT (OFFICE): Department of Transportation
Bureau of Environment

SUBJECT Dredge & Fill Application
Peterborough, 15879

TO Karl Benedict, Public Works Permitting Officer
New Hampshire Wetlands Bureau
29 Hazen Drive, P.O. Box 95
Concord, NH 03302-0095

Forwarded herewith is the application package prepared by NH DOT Bureau of Bridge Design for the subject Major impact project. This project is classified as Major per Env-Wt 303.02(p). The project is located on NH Route 202 / NH Route 101 in the Town of Peterborough, NH. The proposed work consists of replacing bridge #087/077 over the Contoocook River.

This project was reviewed at the Natural Resource Agency Coordination Meeting on April 18, 2012, March 21, 2012, and August 15, 2012. A copy of the minutes have been included with this application package. A copy of this application and plans can be accessed on the Departments website via the following link:
http://www.nh.gov/dot/org/projectdevelopment/environment/units/program-management/wetland-applications.htm

Mitigation is not proposed for this project as it is considered a self-mitigating project.

The lead people to contact for this project are Robert Landry, Administrator, Bureau of Bridge Maintenance (271-2731 or robert.landry@dot.nh.gov) or Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment (271-3226 or Andrew.O'Sullivan@dot.nh.gov).

A payment voucher has been processed for this application (Voucher #589080) in the amount of $7,272.40.

If and when this application meets with the approval of the Bureau, please send the permit directly to Andrew O'Sullivan, Wetlands Program Manager, Bureau of Environment.

AMO:mru
Enclosures

cc:
BOE Original
Town of Peterborough (4 copies via certified mail)
Contoocook River Local Advisory Committee (via certified mail)
David Trubey, NH Division of Historic Resources (Cultural Review Within)
Bureau of Construction
Carol Henderson, NH Fish & Game (via electronic notification)
Maria Tur, US Fish & Wildlife (via electronic notification)
Mark Kern, US Environmental Protection Agency (via electronic notification)
Michael Hicks, US Army Corp of Engineers (via electronic notification)
Kevin Nyhan, BOE (via electronic notification)

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PETERBOROUGH
X-A001 (007)
15879

New Hampshire DOT
Department of Transportation

WETLANDS PERMIT

NOVEMBER 2019

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Standard Dredge and Fill Application

NHDES-W-06-012

WETLANDS PERMIT APPLICATION

Water Division/ Wetlands Bureau

Land Resources Management

Check the status of your application: www.des.nh.gov/onestop

RSA/Rule: RSA 482-A/ Env-Wt 100-900

Administrative Use Only	Administrative Use Only	Administrative Use Only	File No.:
			Check No.:
			Amount:
			Initials:

1. REVIEW TIME: Indicate your Review Time below. To determine review time, refer to Guidance Document A for instructions.

☒ Standard Review (Minimum, Minor or Major Impact) ☐ Expedited Review (Minimum Impact only)

2. MITIGATION REQUIREMENT:

If mitigation is required, a Mitigation-Pre Application meeting must occur prior to submitting this Wetlands Permit Application. To determine if mitigation is required, please refer to the Determine if Mitigation is Required Frequently Asked Questions.

Mitigation Pre-Application Meeting Date: Month: __ Day: __ Year: ____

☒ N/A - Mitigation is not required

3. PROJECT LOCATION:

Separate wetland permit applications must be submitted for each municipality within which wetland impacts occur.

ADDRESS: **US 202 & NH 101 over Contoocook River** TOWN/CITY: **Perterborough**

TAX MAP: **N/A** BLOCK: **N/A** LOT: **N/A** UNIT: **N/A**

USGS TOPO MAP WATERBODY NAME: **Contoocook River** ☐ NA STREAM WATERSHED SIZE: **72.1 square miles** ☐ NA

LOCATION COORDINATES (If known): **42.869025, -71.949565** ☒ Latitude/Longitude ☐ UTM ☐ State Plane

4. PROJECT DESCRIPTION:

Provide a brief description of the project outlining the scope of work. Attach additional sheets as needed to provide a detailed explanation of your project. DO NOT reply "See Attached" in the space provided below.

The project involves the replacement of the US Route 202/NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River in Peterborough, NH, which is on the NHDOT's Red list. The project also includes minor approach road work, stormwater improvements and invasive plant species removal from work-zone. The bridge is in need of replacement due of its severely deteriorated bridge deck (including areas of heavy leaking and cracking on the soffits), spalls at the backwall, under-bridge slope erosion and outdated pier construction. Additionally, the replacement will also provide bridge widening to improve safety issues. These issues include lack of roadway shoulders which forces bicyclists and pedestrians to travel within the vehicle lanes. Additionally, narrow shoulders do not provide for safe emergency stopping and vehicle recovery. The safety concerns associated with vehicle recovery are further exacerbated by outdated guardrails. The replacement project includes complete replacement of the bridge super structure, deck, abutments, piers, foundations along with associated river and bank stabilization.

5. SHORELINE FRONTAGE:

☐ N/A This does not have shoreline frontage. SHORELINE FRONTAGE: **618.8 L.F.**

Shoreline Frontage is calculated by determining the average of the distances of the actual natural navigable shoreline frontage and a straight line drawn between the property lines, both of which are measured at the normal high water line (Env-Wt 101.89).

6. RELATED NHDES LAND RESOURCES MANAGEMENT PERMIT APPLICATIONS ASSOCIATED WITH THIS PROJECT:

Please indicate if any of the following permit applications are required and, if required, the status of the application.

To determine if other Land Resources Management Permits are required, refer to the Land Resources Management Webpage.

Permit Type	Permit Required	File Number	Permit Application Status
Alteration of Terrain Permit Per RSA 485-A:17	☐ YES ☒ NO	____	☐ APPROVED ☐ PENDING ☐ DENIED
Individual Sewerage Disposal per RSA 485-A:2	☐ YES ☒ NO	____	☐ APPROVED ☐ PENDING ☐ DENIED
Subdivision Approval Per RSA 485-A	☐ YES ☒ NO	____	☐ APPROVED ☐ PENDING ☐ DENIED
Shoreland Permit Per RSA 483-B	☒ YES ☐ NO	____	☐ APPROVED ☒ PENDING ☐ DENIED

7. NATURAL HERITAGE BUREAU & DESIGNATED RIVERS:

See the Instructions & Required Attachments document for instructions to complete a & b below.

a. Natural Heritage Bureau File ID: NHB **19** - **2384** .

b. ☒ This project is within a Designated River corridor. The project is within ¼ mile of: _____ ; and date a copy of the application was sent to the Local River Management Advisory Committee: Month: __ Day: __ Year: ____

☐ N/A – This project is not within a Designated River corridor.

8. APPLICANT INFORMATION (Desired permit holder)

LAST NAME, FIRST NAME, M.I.: **Landry, Robert L., P.E.**			
TRUST / COMPANY NAME: **NH Department of Transportation**	MAILING ADDRESS: **PO Box 483**		
TOWN/CITY: **Concord**		STATE: **NH**	ZIP CODE: **03302-483**
EMAIL or FAX: **Robert.Landry@dot.nh.gov**	PHONE: **603-271-2731**		
ELECTRONIC COMMUNICATION: By initialing here: _____, I hereby authorize NHDES to communicate all matters relative to this application electronically.			

9. PROPERTY OWNER INFORMATION (If different than applicant)

LAST NAME, FIRST NAME, M.I.:			
TRUST / COMPANY NAME:	MAILING ADDRESS:		
TOWN/CITY:		STATE:	ZIP CODE:
EMAIL or FAX:	PHONE:		
ELECTRONIC COMMUNICATION: By initialing here _____, I hereby authorize NHDES to communicate all matters relative to this application electronically.			

10. AUTHORIZED AGENT INFORMATION

LAST NAME, FIRST NAME, M.I.: **Lundsted, Ben, P.E.**	COMPANY NAME: **Comprehensive Environmental Inc.**		
MAILING ADDRESS: **21 Depot Street**			
TOWN/CITY: **Merrimack**		STATE: **NH**	ZIP CODE: **03054**
EMAIL or FAX: **blundsted@ceiengineers.com**	PHONE: **603-429-3584**		
ELECTRONIC COMMUNICATION: By initialing here _____, I hereby authorize NHDES to communicate all matters relative to this application electronically.			

11. PROPERTY OWNER SIGNATURE:

See the Instructions & Required Attachments document for clarification of the below statements

By signing the application, I am certifying that:

1. I authorize the applicant and/or agent indicated on this form to act in my behalf in the processing of this application, and to furnish upon request, supplemental information in support of this permit application.
2. I have reviewed and submitted information & attachments outlined in the Instructions and Required Attachment document.
3. All abutters have been identified in accordance with RSA 482-A:3, I and Env-Wt 100-900.
4. I have read and provided the required information outlined in Env-Wt 302.04 for the applicable project type.
5. I have read and understand Env-Wt 302.03 and have chosen the least impacting alternative.
6. Any structure that I am proposing to repair/replace was either previously permitted by the Wetlands Bureau or would be considered grandfathered per Env-Wt 101.47.
7. I have submitted a Request for Project Review (RPR) Form (www.nh.gov/nhdhr/review) to the NH State Historic Preservation Officer (SHPO) at the NH Division of Historical Resources to identify the presence of historical/ archeological resources while coordinating with the lead federal agency for National Historic Preservation Act (NHPA) 106 compliance.
8. I authorize NHDES and the municipal conservation commission to inspect the site of the proposed project.
9. I have reviewed the information being submitted and that to the best of my knowledge the information is true and accurate.
10. I understand that the willful submission of falsified or misrepresented information to the NHDES is a criminal act, which may result in legal action.
11. I am aware that the work I am proposing may require additional state, local or federal permits which I am responsible for obtaining.
12. The mailing addresses I have provided are up to date and appropriate for receipt of NHDES correspondence. NHDES will not forward returned mail.

Property Owner Signature	Print name legibly	Date / /

MUNICIPAL SIGNATURES

12. CONSERVATION COMMISSION SIGNATURE

The signature below certifies that the municipal conservation commission has reviewed this application, and:

1. Waives its right to intervene per RSA 482-A:11;
2. Believes that the application and submitted plans accurately represent the proposed project; and
3. Has no objection to permitting the proposed work.

⇨	Print name legibly	Date

DIRECTIONS FOR CONSERVATION COMMISSION

1. Expedited review ONLY requires that the conservation commission's signature is obtained in the space above.

2. Expedited review requires the Conservation Commission signature be obtained **prior** to the submittal of the original application to the Town/City Clerk for signature.

3. The Conservation Commission may refuse to sign. If the Conservation Commission does not sign this statement for any reason, the application is not eligible for expedited review and the application will be reviewed in the standard review time frame.

13. TOWN / CITY CLERK SIGNATURE

As required by Chapter 482-A:3 (amended 2014), I hereby certify that the applicant has filed four application forms, four detailed plans, and four USGS location maps with the town/city indicated below.

⇨	Print name legibly	Town/City	Date

DIRECTIONS FOR TOWN/CITY CLERK:

Per RSA 482-A:3,I

1. For applications where "Expedited Review" is checked on page 1, if the Conservation Commission signature is not present, NHDES will accept the permit application, but it will NOT receive the expedited review time.
2. IMMEDIATELY sign the original application form and four copies in the signature space provided above;
3. Return the signed original application form and attachments to the applicant so that the applicant may submit the application form and attachments to NHDES by mail or hand delivery.
4. IMMEDIATELY distribute a copy of the application with one complete set of attachments to each of the following bodies: the municipal Conservation Commission, the local governing body (Board of Selectmen or Town/City Council), and the Planning Board; and
5. Retain one copy of the application form and one complete set of attachments and make them reasonably accessible for public review.

DIRECTIONS FOR APPLICANT:

1. Submit the single, original permit application form bearing the signature of the Town/ City Clerk, additional materials, and the application fee to NHDES by mail or hand delivery.

14. IMPACT AREA:

For each jurisdictional area that will be/has been impacted, provide square feet and, if applicable, linear feet of impact.

Permanent: *impacts that will remain after the project is complete.*

Temporary: *impacts not intended to remain (and will be restored to pre-construction conditions) after the project is completed.*

Intermittent Streams: *linear footage distance of disturbance is measured along the thread of the channel.*

Perennial Streams/ Rivers: *the total linear footage distance is calculated by summing the lengths of disturbance to the channel and each bank.*

JURISDICTIONAL AREA	PERMANENT Sq. Ft. / Lin. Ft.		TEMPORARY Sq. Ft. / Lin. Ft.	
Forested wetland		☐ ATF		☐ ATF
Scrub-shrub wetland	15 / 13	☐ ATF	1,424 / 161	☐ ATF
Emergent wetland	675 / 70	☐ ATF	3,935 / 57	☐ ATF
Wet meadow		☐ ATF		☐ ATF
Intermittent stream channel	/	☐ ATF	/	☐ ATF
Perennial Stream / River channel	899 / 124	☐ ATF	9,173 / 139	☐ ATF
Lake / Pond	/	☐ ATF	/	☐ ATF
Bank - Intermittent stream	/	☐ ATF	/	☐ ATF
Bank - Perennial stream / River	781 / 236	☐ ATF	1,279 / 243	☐ ATF
Bank - Lake / Pond	/	☐ ATF	/	☐ ATF
Tidal water	/	☐ ATF	/	☐ ATF
Salt marsh		☐ ATF		☐ ATF
Sand dune		☐ ATF		☐ ATF
Prime wetland		☐ ATF		☐ ATF
Prime wetland buffer		☐ ATF		☐ ATF
Undeveloped Tidal Buffer Zone (TBZ)		☐ ATF		☐ ATF
Previously-developed upland in TBZ		☐ ATF		☐ ATF
Docking - Lake / Pond		☐ ATF		☐ ATF
Docking - River		☐ ATF		☐ ATF
Docking - Tidal Water		☐ ATF		☐ ATF
Vernal Pool		☐ ATF		☐ ATF
TOTAL	2,370 / 443		15,811 / 600	

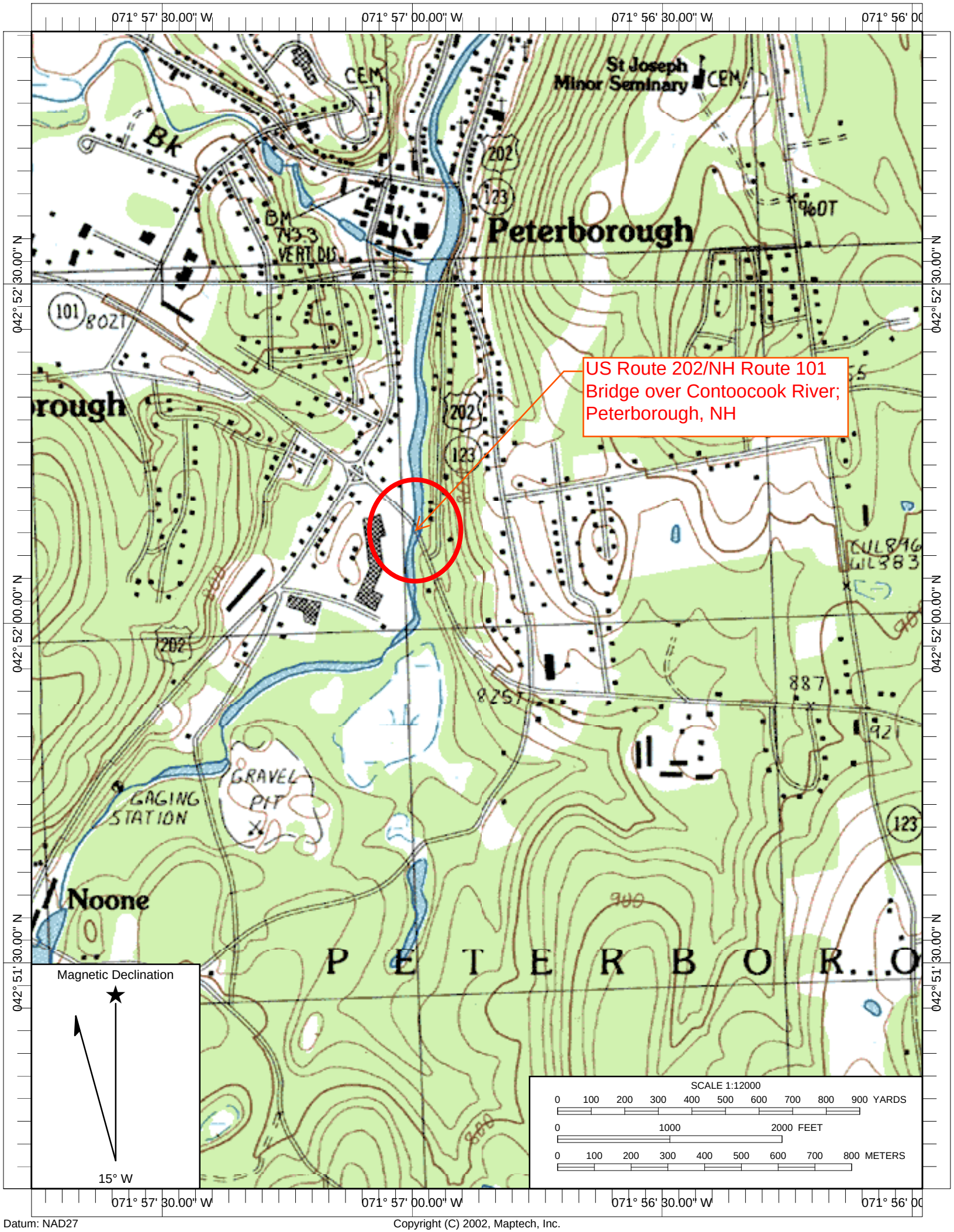
15. APPLICATION FEE: See the Instructions & Required Attachments document for further instruction

☐ Minimum Impact Fee or Fee for Non-enforcement related, publicly-funded and supervised restoration projects, regardless of impact classification (see RSA 482-A:3, 1(c)): Flat fee of $ 400

☒ Minor or Major Impact Fee: Calculate using the below table below

Permanent and Temporary (non-docking)	**18,181** sq. ft.	X	$0.40 =	$ **7,272.40**
Temporary (seasonal) docking structure:	sq. ft.	X	$2.00 =	$
Permanent docking structure:	sq. ft.	X	$4.00 =	$
Projects proposing shoreline structures (including docks) add $400 =				$
Total =				$ **7,272.40**
The Application Fee is the above calculated Total or $400, whichever is greater =				$ **7,272.40**

USGS Locus Map



Datum: NAD27

Env-Wt 302.04 – NH DES Permit Application Attachment A

Minor and Major 20 Questions

WETLANDS PERMIT APPLICATION – ATTACHMENT A
MINOR AND MAJOR - 20 QUESTIONS

Land Resources Management
Wetlands Bureau

Check the Status of your application: www.des.nh.gov/onestop

RSA/ Rule: RSA 482-A, Env-Wt 100-900

Env-Wt 302.04 Requirements for Application Evaluation - For any major or minor project, the applicant shall demonstrate by plan and example that the following factors have been considered in the project's design in assessing the impact of the proposed project to areas and environments under the department's jurisdiction. Respond with statements demonstrating:

1. The need for the proposed impact.

The need for impact is caused by the need to replace the existing bridge caused by the poor condition of the bridge deck, structural concerns with the pier and piles and the safety concerns created by the narrow width of the bridge. The US Route 202/ NH Route 101 bridge is currently on the NHDOT Red List of bridges in need of repair or replacement due of its severely deteriorated bridge deck, including areas of heavy leaking and cracking on the soffits and efflorescence on about 25 percent of each span (NHDOT Bridge Design Inspection Reports). There are also spalls at the back wall and both sides have under slope erosion. Additionally, upon further review and discussion of unconfirmed pile lengths, the pier analysis results, pier retrofit concepts, bridge replacement concepts and estimated construction costs, it was determined that the bridge should be replaced. The bridge also has safety issues which include insufficient shoulder width (1'-6"), lack of a sidewalk on the north side, insufficient ability for emergency stopping and vehicle retrieval, and inadequate facilities for bicycle and pedestrian traffic. Multiple accidents have occurred along this section of roadway.

The purpose of this project is to correct structural deficiencies and address safety concerns associated with this bridge.

2. That the alternative proposed by the applicant is the one with the least impact to wetlands or surface waters on site.

Alternatives developed for this project during NEPA Re-evaultion in October 2019 included constructing a new crossing parallel to the existing bridge and differing phased construction, all resulting in more wetland impacts than the preferred alternative. More detailed alternative analysis from the NEPA Categorical Exclusion is available upon request.

3. The type and classification of the wetlands involved.

Jurisdictional resource areas that will be impacted by this project include the main channel and bank of the Contoocook River (a designated river) and wetlands adjacent to the roadway and bridge.

R2UBH (Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded); R4SB6 (Riverine, Intermittent, Streambed, Organic); PUBHh (Palustrine, Unconsolidated Bottom, Permanently Flooded, Diked / Impounded); PSS1Ud (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Unknown (Water Regime), Partially Drained / Ditched); PSS1c (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous, Seasonally Flooded).

4. The relationship of the proposed wetlands to be impacted relative to nearby wetlands and surface waters.

Impacted wetlands consist of scrub-shrub, as well as palustrine, riverine, and bank. The wetland to the northeast appears to be associated with a surface drainage discharge which ultimately flows into the Contoocook River. The wetland to the southeast appears to be formed by the puddling of surface discharge from the adjacent roadway embankment before ultimately discharging to the Contoocook River.

5. The rarity of the wetland, surface water, sand dunes, or tidal buffer zone area.

The wetlands that will be impacted by the proposed work are not rare. There are no identified prime wetlands in the project area.

6. The surface area of the wetlands that will be impacted.

Wetland impacts are summarized in the Wetland Impact Table on Sheet 7 of the Wetland Plans. Permanent impacts equal 2,370 square feet and temporary impacts equal 15,811 square feet.

7. The impact on plants, fish and wildlife including, but not limited to:
   a. Rare, special concern species;
   b. State and federally listed threatened and endangered species;
   c. Species at the extremities of their ranges;
   d. Migratory fish and wildlife;
   e. Exemplary natural communities identified by the DRED-NHB; and
   f. Vernal pools.

a. New Hampshire Natural Heritage Bureau provided information which determined that even though there was a species present in the vicinity of the specified area, it is not expected to be impacted by the project

b. The United States Fish and Wildlife Service and the New Hampshire Fish and Game Department were contacted regarding threatened endangered species concerns in / around the Contoocook River and nearby wetlands. The responses, attached to this application, confirmed potential concerns for impacts to those species as a result of the proposed project. The NH DOT responded to these concerns, and mitigation / protection measures for these species will be put into place during construction. (See attached correspondences and narrative)

c. As noted above.

d. Impacts to species will be temporary and partial related to construction activities. Passage within the river will remain at least partially open at all times and a "shelf" will be provided on the east bank. The National Marine Fisheries Service (NMFS) was contacted regarding migratory fish and wildlife species concerns in the Contoocook River. An Essential Fish Habitat (EFH) Assessment was completed and NMFS did not expect any impacts to the species from the proposed project (see attached correspondence).

e. As noted above.

f. Vernal pools;

There are no vernal pools in the vicinity of the project.

8. The impact of the proposed project on public commerce, navigation and recreation.

This project will improve public commerce by improving the safety along NH Route 101 for motorists, bicyclists, and pedestrians. Recreational opportunities will be improved for bicyclists and pedestrians with the increased shoulder width. Access will be maintained to nearby businesses and residences during construction. The river will remain partially open during construction. The portion of the common pathway which runs along the west bank of the river under the bridge will only be temporarily closed during construction for safety reasons.

9. The extent to which a project interferes with the aesthetic interests of the general public. For example, where an applicant proposes the construction of a retaining wall on the bank of a lake, the applicant shall be required to indicate the type of material to be used and the effect of the construction of the wall on the view of other users of the lake.

The proposed reconstruction and widening of the NH Route 101 bridge will only temporarily visually impact the area.

10. The extent to which a project interferes with or obstructs public rights of passage or access. For example, where the applicant proposes to construct a dock in a narrow channel, the applicant shall be required to document the extent to which the dock would block or interfere with the passage through this area.

The proposed project will not permanently interfere with or obstruct public rights of passage or access. Access will be maintained to nearby businesses and residences during. The portion of the common pathway which runs along the west bank of the river under the bridge will only be temporarily closed during construction for safety reasons.

11. The impact upon abutting owners pursuant to RSA 482-A:11, II. For example, if an applicant is proposing to rip-rap a stream, the applicant shall be required to document the effect of such work on upstream and downstream abutting properties.

Impacts to abutting properties have been minimized as much as possible. The proposed Temporary Slope Easement to the southeast will allow the contractor access only during construction to construct the proposed reconstructed roadway embankment slope.

12. The benefit of a project to the health, safety, and well being of the general public.

This project will be a benefit to the public's health and safety. The proposed shoulders on the roadway will improve safety for bicyclists and pedestrians to be outside of the traveled way and provide safe emergency stopping and vehicle recovery for motorists.

13. The impact of a proposed project on quantity or quality of surface and ground water. For example, where an applicant proposes to fill wetlands the applicant shall be required to document the impact of the proposed fill on the amount of drainage entering the site versus the amount of drainage exiting the site and the difference in the quality of water entering and exiting the site.

There will only be a slight increase of impervious area due to the proposed widening of the shoulders and bridge; In general, the proposed design will not change the quantity of water passing through the site.

Various Best Management Practices (BMPs) were evaluated for use within this project. Right-of-way, wetlands, steep slopes, and the close proximity of the adjacent businesses have prevented the use of above ground BMPs. An infiltrating catch basin was proposed in the median at the Granite Street intersection, however borings in this location have indicated unsuitable soils for infiltration. This project proposes the use of deep sump catch basins for pretreatment of stormwater to help remove total suspended solids before the stormwater flows through adjacent wetlands to the Contoocook River. Outlet pipe hoods are proposed within these catch basins to contain floatable debris from within the stormwater. A swale is proposed west of the bridge between the Shopping Plaza and Route 101. This swale will not provide complete treatment per NHDES regulations, however it will provide some.

14. The potential of a proposed project to cause or increase flooding, erosion, or sedimentation.

The proposed project is not expected to cause increased flooding, erosion, or sedimentation. Existing drainage channels will be outfitted with check dams to provide sediment retention beyond what currently exists.

Hydraulic analyses were also completed to ensure that no increase in flooding will occur. For details of HEC-RAS analysis please see NEPA documentation.

Appropriate temporary construction erosion control BMPs will also be utilized as outlined in the attached plans.

15. The extent to which a project that is located in surface waters reflects or redirects current or wave energy which might cause damage or hazards.

Not applicable, the proposed project will not be reflecting or redirecting current or wave energy.

16. The cumulative impact that would result if all parties owning or abutting a portion of the affected wetland or wetland complex were also permitted alterations to the wetland proportional to the extent of their property rights. For example, an applicant who owns only a portion of a wetland shall document the applicant's percentage of ownership of that wetland and the percentage of that ownership that would be impacted.

Not applicable, the State of New Hampshire Department of Transportation is the only abutter to wetland areas.

17. The impact of the proposed project on the values and functions of the total wetland or wetland complex.

Interruptions to the functions of the river will be partial and temporary in nature. Construction techniques which do not impact wildlife use of the river (by keeping an open water channel available at all times) will be employed such as existing structure supported debris containment during demolition and phased (utilizing temporary causeway(s) and/or a trestle) construction of removal of the existing piers. The value of these functions will not be permanently impacted. The flood storage component of the wetlands located to the north and southeast of the bridge will be retained. The value of these wetlands functions related to wildlife and vegetation will not be permanently impacted and will be improved with the removal of small invasive shrubs located within the work limits adjacent to the wetlands by reducing the risk of spread of these invasives into the wetlands.

18. The impact upon the value of the sites included in the latest published edition of the National Register of Natural Landmarks, or sites eligible for such publication.

No impacts to National Register of Natural Landmarks are proposed.

19. The impact upon the value of areas named in acts of congress or presidential proclamations as national rivers, national wilderness areas, national lakeshores, and such areas as may be established under federal, state, or municipal laws for similar and related purposes such as estuarine and marine sanctuaries.

The Contoocook River was listed on the Nationwide Rivers Inventory in 1982 and 1995. This project is not expected to permanently impact the outstandingly remarkable values consisting of the historic, recreational, hydrologic, and botanic resources along the river.

20. The degree to which a project redirects water from one watershed to another.

A hydrologic study shows that no redirection of water from one watershed to another is proposed for this project.

Additional comments

Standard Dredge and Fill Supplemental Narrative

Standard Dredge and Fill Supplemental Narrative

Introduction and Description of Project

The project involves the replacement of the US Route 202/NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River in Peterborough, NH (Attachment A), which is on the NHDOT's Red list. The project also includes minor approach road work, stormwater improvements and invasive plant species removal from impacted work-zone.

The bridge, which was constructed in 1958, consists of 3 spans with 2 river piers and carries approximately 16,500 vehicles per day. The bridge has one travel lane in each direction and a dedicated left turn lane serving Route 202 North (Granite Street). The existing lanes are narrow with inadequate shoulders. Photographs of the proposed project area are provided as an attachment to this report (Attachment J).

The area is characterized by a mix of commercial and residential land uses. On the west side of the Contoocook River to the southwest of the bridge is a large parcel containing the Peterborough Shopping Plaza. Directly across Routes 101/202 to the northwest is a gas station and Dunkin' Donuts. A recently constructed shared use bicycle/ walk path runs along the western river bank under the bridge. The east bank of the river is steeply sloping and largely undeveloped. To the northeast of the bridge are three homes along the west side of Route 202 north.

The project area crosses over the Contoocook River, a 71 mile long waterway that flows northward and empties into the Merrimack River near Concord, NH. The portion of the project area on the west side of the Contoocook River is underlain entirely by Udorthents (fill). The portion of the project area on the eastern side is underlain by a variety of till soils, including Adams loamy sand, Colton loamy sand and Rumney loam.

Existing Conditions / Project Purpose and Need

The need for this project is demonstrated by the poor condition of the bridge deck, structural concerns with the pier and piles and the safety concerns created by the narrow width of the bridge. The US Route 202/ NH Route 101 bridge is currently on the NHDOT Red List of bridges in need of repair or replacement due of its severely deteriorated bridge deck, including areas of heavy leaking and cracking on the soffits and efflorescence on about 25 percent of each span (NHDOT Bridge Design Inspection Reports). In addition, there are spalls at the backwall and both sides have under slope erosion. Following a detailed pier analysis, it was determined that the bridge should be replaced.

Though there is a designated shared-use path located beneath the bridge designed for bicycle and pedestrian traffic it is limited to users on the west side of the bridge only. The lack of roadway shoulders forces bicyclists and pedestrians to travel within the vehicle lanes and does not provide for safe emergency stopping and vehicle recovery. The safety concerns associated with vehicle recovery are further exacerbated by outdated guardrails.

According to the Town's Police Chief, there are approximately 10 automobile accidents each year in the area just west of the bridge. The primary cause of these accidents is the shared center turn lane, which allows both eastbound and westbound traffic to enter the shopping center or the gas station from NH Route 101.

The purpose of this project is to correct structural deficiencies and safety concerns associated with this bridge, which include insufficient shoulder width (1'-6"), lack of a sidewalk on the north side, insufficient ability for emergency stopping and vehicle retrieval, and inadequate facilities for bicycle and pedestrian traffic.

Alternatives Overview

Environmental and traffic impacts were analyzed for several proposed alternatives, however, based on the structural pier analysis findings and for safety purposes, the complete bridge replacement was selected as the preferred alternative. This alternative results in a wider bridge which will more easily facilitate traffic control for future deck maintenance projects. Phasing the construction allows traffic to continue to flow along NH Route 101 which alleviates the potential for substantial increases in diverted traffic onto local roadways in town. Additionally, widening the bridge addresses the issue of undersized lanes and shoulders currently on the NH Route 101/US Route 202 Bridge, as well as providing a sidewalk to improve pedestrian safety. This alternative addresses the deficient structural integrity, while allowing for maintenance of vehicular traffic without detour.

Project Proposal/Preferred Alternative

The proposed project will consist of the following:

Bridge Widening (Upstream Side) with Full Pier and Abutment Replacement

- Bridge Piers and Abutments: The existing bridge piers will be replaced with a single open pier constructed in a location between the existing piers. The new pier will be longer than the original to accommodate the new and wider bridge superstructure (concrete deck and steel girders) and will consist of four columns spaced at 18’-9”. The two existing bridge solid piers will be removed in their entirety. New wider bridge abutments will be constructed in close proximity to the existing abutments to accommodate the proposed bridge geometry.
- Bridge Widening (1st Phase): During the first phase of construction, approximately 17’ of the bridge (on the upstream side) would be closed for construction while the other side would function as one 14’ wide temporary westbound travel lane and one 12’ temporary travel eastbound travel lane. On the upstream side of the bridge, sections of the existing piers and abutments will be demolished once the existing bridge deck and girders are removed. The new abutments and pier will then be constructed and extended by approximately 20’ upstream from the original pier and abutment configuration. Due to slope embankment work and grading associated with the new abutment construction, the Common Pathway will be widened and re-graded.
- Bridge Widening (2nd Phase): During the second phase of construction of this alternative, the portion of the bridge that was used for travel during the first phase will be completely replaced (approximately 34’). The side of the bridge replaced in the first phase would then serve as the temporary travel lanes (1 – 12’-6” and 1 – 11’-6” lanes). Once the remaining existing bridge

deck and girders are removed, the remainder of the existing piers and abutments will be demolished. The remainder of the proposed pier and abutments will be constructed to accommodate the new wider bridge superstructure (concrete deck and steel girders) on the downstream end to the extents of the previous bridge configuration.

Alternatives Considered & Avoidance Minimization

Several alternatives for this project were considered, for more detailed alternative analysis refer to Categorical Exclusion & De Minimis 4(f) Determination Report dated February 2014. The project was reviewed by the ACOE, NHDES, NH Fish and Game (NHF&G), US Environmental Protection Agency (EPA), the Federal Highway Administration (FHWA) and several other agencies/organizations. None of the agencies or organizations objected to the preferred alternative.
The alternative with the least impact to the environment was chosen.

Wetlands and Resource Area Impacts

Given the close proximity of the project area to the Contoocook River it is anticipated that there will be temporary and permanent impacts to surface waters and wetlands within the project area. The project contractor will be required to prepare an erosion control and Storm Water Pollution Prevention Plan (SWPPP), approved by the Department, prior to the commencement of construction activities. Standard pollution prevention measures will be employed to assure all negative impacts are avoided and/or minimized to the maximum extent practicable. Appropriate best management practices will be utilized during construction to prevent the introduction and spread of invasive plants.

Wetland Impacts

The wetland resources within the limits of the project have been delineated based on the 1987 Federal Manual for Identifying and Delineating Jurisdictional Wetlands, produced by the ACOE, Wetlands Research Program. The jurisdictional wetland areas within the project limits include the Contoocook River as well as small wetland pockets to the southeast and northeast side of the bridge.

As stated above, jurisdictional wetland areas including bordering vegetated wetlands and the Contoocook River will be impacted by the removal of the existing piers and installation of the new abutments and pier. Installation of the proposed piers and removal of the old piers will require dredging of river bottom materials. Total wetland impacts resulting from the proposed project are estimated to be 2,370 sq.ft. of permanent impact and 15,811 sq.ft. of temporary impact as shown on the wetland plans. (Attachment O).

Impacts to wetland “K” to the southeast of the bridge were discussed during Natural Resource Agency Meetings on April 18, 2012 and August 15, 2012. As requested the design team presented alternatives to avoid impacts to this wetland and the final proposed design does not permanently impact the wetland.

Shoreland Impacts

The reference line for the Shoreland Water Quality Protection Act is the normal high water elevation and the Shoreland zone extends from that reference line to a point 250’ landward of the reference line. Impacts are estimated at approximately 8,439 sq.ft. of new impervious surface within the

Shoreland zone (associated with bridge approach widening to match the widened bridge) and approximately 61,772 sq.ft. of temporary impacts (associated with temporary excavations and grading associated with widening and slope work). The appropriate permits from DES and ACOE will be obtained prior to construction. A separate Shoreland Permit application is being submitted to DES for this project.

Surface Water Impacts / NH Designated Rivers

The project involves minor impacts to the banks and channels of the Contoocook River, which is a NH Designated River. The New Hampshire Rivers Management and Protection Program (RMPP) was established in 1988 with the passage of RSA 483 to protect certain rivers, called designated rivers, for their outstanding natural and cultural resources. The program is administered by New Hampshire DES.

The local representative of the Contoocook River Local Advisory Committee (LAC) was consulted on the project (Attachment M). The main concern was the protection of the river from construction debris during the project. Since the Contoocook is a Designated River, NHDES encourages initial consultation with the LAC regarding Wetlands and Shorelands Permit Applications and copies of the Applications are required to be submitted to the LAC for review and comment back to NHDES. To address the LAC's concern, water diversion structures for the pier removal and construction are proposed as well as shielding to make sure debris from demolition does not end up in the Contoocook River.

Floodplains/ Floodway Impacts

Peterborough is a community that participates in the National Flood Insurance Program. The project lies within areas delineated as Floodway Areas, Special Flood Hazard Areas, and Zone X on the Flood Insurance Rate Map. The Floodway Area is defined by the Federal Emergency Management Agency (FEMA) as "the channel of the river plus any adjacent floodplain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights." Special Flood Hazard Areas are subject to inundation by the 100-year flood. Zone X areas are those areas that are subject to the 500-year flood or areas that are subject to the 100-year flood but with average depths of less than one foot.

Although the project is not expected to produce increased flooding potential, it includes impacts within the floodway of the Contoocook River. Since the project requires fill and excavation within the existing floodway, the Department has conducted a hydraulic analysis of the proposed design to determine if the project will result in a change of the existing base flood elevations.

The Office of Energy and Planning (OEP) has previously noted that coordination with FEMA will be required if the proposed project causes any increase in the base flood elevation within the regulatory floodway. The proposed design will alter the cross-section of the river at the bridge (existing piers will be removed and new a new pier line will be installed at approximate mid-span of the bridge. Abutments will be replaced that are wider and have new alignments and skews relative the river channel). Based on the proposed cross-section changes, hydraulic modeling confirms that there will be no increase in base flood elevation (BFE). (For more information see the Hydrologic and Hydraulic Evaluation Report)

Water Quality Treatment

Water Quality/Stormwater treatment for the project has been analyzed since pre-preliminary design, as detailed in the Hydrologic and Hydraulic Study included as Attachment P. During development of the 2014 Categorical Exclusion, multiple options were considered, including use of an infiltration basin or infiltration manhole. Geotechnical data was obtained after the Categorical Exclusion was finalized and it was determined that these options were infeasible as the soils within the site will not infiltrate as originally thought. The NEPA document was Re-evaluated in 2019 and erroneously carried forward the proposed use of an infiltration manhole.

The proposed method of treatment for the project, as indicated on the attached plans, includes deep sump catch basins within the roadway to provide pretreatment and a swale located in front of the retaining wall by the Peterborough Plaza. The swale is not long enough to meet the criteria to classify it as a "treatment swale", due to site constraints, however, it will provide limited treatment of stormwater and will be an improvement over existing conditions.

Wildlife Reviews

Wildlife/ Endangered Species/ Fisheries/ Natural Communities

In a letter dated June 12, 2015 and in a letter dated August 8, 2019 the NH NHB determined that even though there was a species present in the vicinity of the specified area, it is not expected to be impacted by the project. Refer to correspondence in Attachment E.

The proposed action has been reviewed by the NH Fish and Game Department (NHFG) and the US Fish and Wildlife Service (USF&WS) for the presence of Federal or State, listed or proposed, threatened or endangered species, or other species or plant communities of special or exemplary status (Attachments F & G respectively). In a letter dated July 26, the USF&WS responded that they had some concerns about the Northern Long Eared Bat (NLEB) in the project area. In August, 2019, the USF&WS confirmed that an assessment was done on the project using IPaC. On August 28, 2019, the NHDOT determined that the project is likely to adversely affect the NLEB, as the project includes tree clearing that will be conducted during the NLEB active season in Peterborough. The DOT proposed to employ appropriate Avoidance and Mitigation Measures as indicated in the LAA Consistency Letter for the Project (see Attachment G).

In an email dated August 20, 2019, NHFG responded that they did not expect impacts to any species or habitats of concern as a result of the proposed bridge replacement, but specific conditions must be followed (see Attachments F & G).

The Habitat Conservation Division of the NOAA/National Marine Fisheries Service (NMFS) was consulted regarding potential Essential Fish Habitat (EFH). The Contoocook River has been identified as potential habitat for the Atlantic salmon since it is a tributary to the Merrimack River, and an EFH Assessment Worksheet was completed for the proposed replacement. The assessment concluded that temporary impacts to potential habitat would occur during construction. The use of appropriate construction BMPs and implementation of a Stormwater Pollution Prevention Plan (SWPPP) would minimize potential temporary impacts; therefore, it was determined that "the adverse effect on EFH is

not substantial". NMFS concurred with the assessment and noted "we [NMFS] have no EFH conservation recommendations to provide for this action pursuant to Section 305(b)(4)(A) of the Magnuson-Stevens Act" (see Attachment L).

In accordance with the NH Invasive Species Act (ISA), (HB 1258-FN) The NH Department of Agriculture, Markets and Food (DAMF), Division of Plant Industry is responsible for the evaluation publication and development of rules on invasive plant species. The purpose of this oversight is to protect the health of native species, the environment, commercial agriculture, forest crop production and human health. DAMF rules, specifically AGR 3800, state that "no person shall knowingly collect, transport, import, export, move, buy, sell, distribute, propagate or transplant any living or viable portion of any listed prohibited invasive plant species, which includes all of their cultivars and varieties, listed." Pursuant to this rule, the project area was reviewed for invasive species during the initial phases of design. A few occurrences of Japanese Barberry (*Berberis thunbergii*), European Barberry (*Berberis vulgaris*), Garlic Mustard (*Alliaria petiolata*) and several of Glossy Buckthorn (*Rhamnus frangula*) were found within the project area. Some of these plants (single, shrub-like) will be impacted during construction and will be handled and disposed of in accordance with the NHDOT's Best Management Practices for Roadside Invasive Plants manual. Fill materials brought onsite or transported within the site will be free of invasive species or treated in accordance with the above noted BMP manual to prevent the spread of such species.

Natural and Cultural Resources Review

Per an email dated July 19, 2019, the NH DOT cultural resources manager confirmed that a section 106 re-evaluation is not needed (see Attachment H).

This project was also discussed during two Natural Resource Agency meetings on April 18th and August 15th, 2012. The excerpts from these meetings can be seen in Attachment B.

Stream Crossing Evaluation

The proposed bridge crossing was evaluated and designed in accordance with the NH Stream Crossings Rules. A River Survey and Fluvial Geomorphic Assessment were completed for the project (Attachment D). The report concludes that the width of the existing and proposed spans is wider than the bankfull channel and that the crossing is compatible with the current stream type. For more detail refer to the Categorical Exclusion & De Minimis 4(f) Determination Report dated February 2014.

Env-Wt 404 Criteria for Shoreline Stabilization

The bridge pier and abutment improvements propose stone fill on the sloped banks of the River above a naturally occurring "shelf" area on the east bank as depicted on the attached plans. Pursuant to Env-Wt 404 Criteria for Shoreline Stabilization, the following addresses each codified section of the Administrative Rules:

Wt 404.01 Least Intrusive Method

The riverbank stabilization treatment proposed is the least intrusive construction method necessary to minimize the disruption to the existing shorelines. The stone treatment can be reasonably constructed utilizing general highway construction methods. Because of the potential erosive forces of the Contoocook River, other less intrusive methods are not practiced for use.

Wt 404.02 Diversion of Water

Work along the banks of the Contoocook River will require temporary diversions utilizing temporary causeways. Proper diversion methods, water handling, dewatering and erosion control measures will be implemented during construction and work will be phased such that a natural bed corridor will be maintained at all times within the channel.

Wt 404.03 Vegetative Stabilization

Natural vegetation will be left undisturbed to the maximum extent possible. The shelf on the east bank will be vegetated.

Wt 404.04 Rip-Rap

(a) Riprap is proposed under the bridge and along the proposed pedestrian walkway as shown on the attached plan sheets to protect impacted portions of the river banks adjacent to the bridge abutments against erosion and scour above the "shelf". The riprap will also be installed along slopes adjacent to abutment walls. Stable banks are necessary to maintain the structural integrity of the roadway, bridge, and abutments during all flow conditions.

(b) Class V Riprap will be used for bank stabilization and shall meet the following requirements:

(1) The designation for minimum and maximum stone size shall be 18" and 36" respectively (see table 583-1 below).

(2) Gradation for class V riprap shall follow the standards set for by the NHDOT (see table 583-1 below).

Table 583-1

Riprap Classes and Sizes			Percentage Distribution of Particle Sizes by Volume (cubic feet)			
Class	Nominal Size (in)	Maximum Size (in)	< 15%	15% – 85%	> 85%	Maximum
I	6	12	0.05	0.14	0.31	1.0
III	12	24	0.4	1.0	2.5	6.5
V	18	36	1.3	3.5	8.5	22
VII	24	48	3	8	19	53
IX	36	72	10	27	65	179

Note: Nominal Size and Maximum Size are based on the Width dimension of the stone. The riprap classes conform to the standard classes described in the FHWA HEC-23 publication.

(3) The minimum thickness in front of the bridge abutments shall be 3 feet.

(4) Bedding for stone fill will be approved gravel meeting NHDOT specifications.

(5) Existing stone fill is shown on the proposed project plan views (Attachment I). Stone fill will be removed and reset to meet existing conditions.

(6) The attached plan sheets (Attachment I) indicate the relationship of the proposed project stone fill to fixed points of reference, abutting properties, and features of the natural shoreline.

(7) A hydraulic analysis was completed to determine anticipated velocities and scour which provides substantiation for the recommended stone stabilization methods and sizes in lieu of vegetation used at drainage outfalls and along impacted sections of riverbanks. (See NEPA documentation for more information).

(c) Stamped surveyed plans indicating the location of the normal high water shoreline and the footprint of the proposed project are located in Attachment O.

(d) Riprap for river bank armoring in front of the proposed abutment walls is proposed to protect the slope from erosion. All proposed riprap is located shoreward of the normal high water shoreline and will not extend more than 2 feet into the river of that line at any point. Vegetation will not be practical due to the lack of sun light.

(e) Plans are being provided as a part of the application. There is no rip-rap in excess of 100 linear feet proposed along river and stream banks.

Wt 404.05 Walls

(a) New abutment walls are proposed for this non-tidal water project.

(1) Abutment walls are necessary for bridge construction.

(2) The attached plan sheets (Attachment O) indicate the relationship of the proposed project abutment walls to fixed points of reference, abutting properties, and features of the natural shoreline.

(3) Abutment walls are located on the shoreward side of the normal high water shoreline.

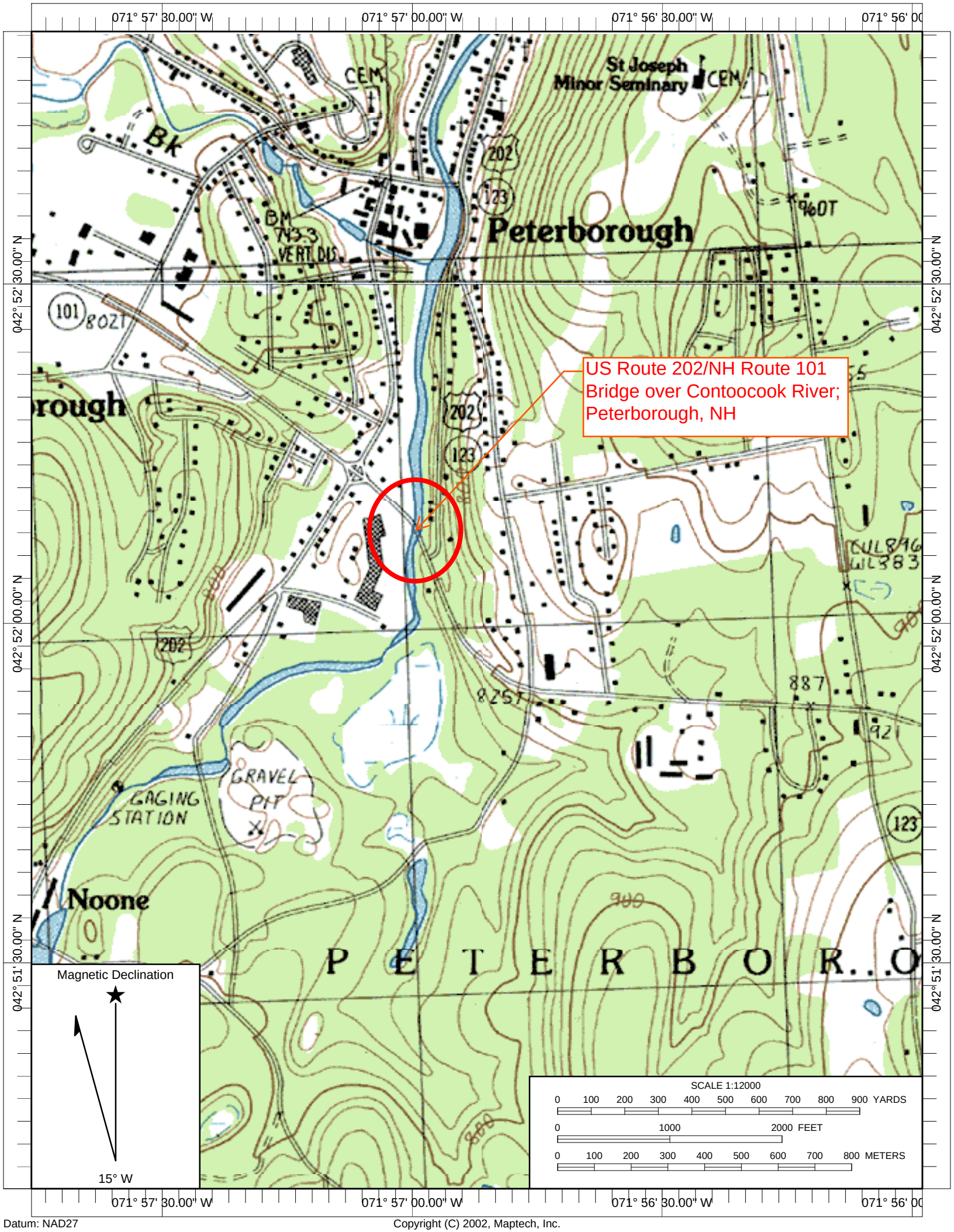
(4) This Application includes attached plan sheets (Attachment O) with a stamped surveyed plan showing the location of the normal high water shoreline and the footprint of the proposed project.

Attachment A

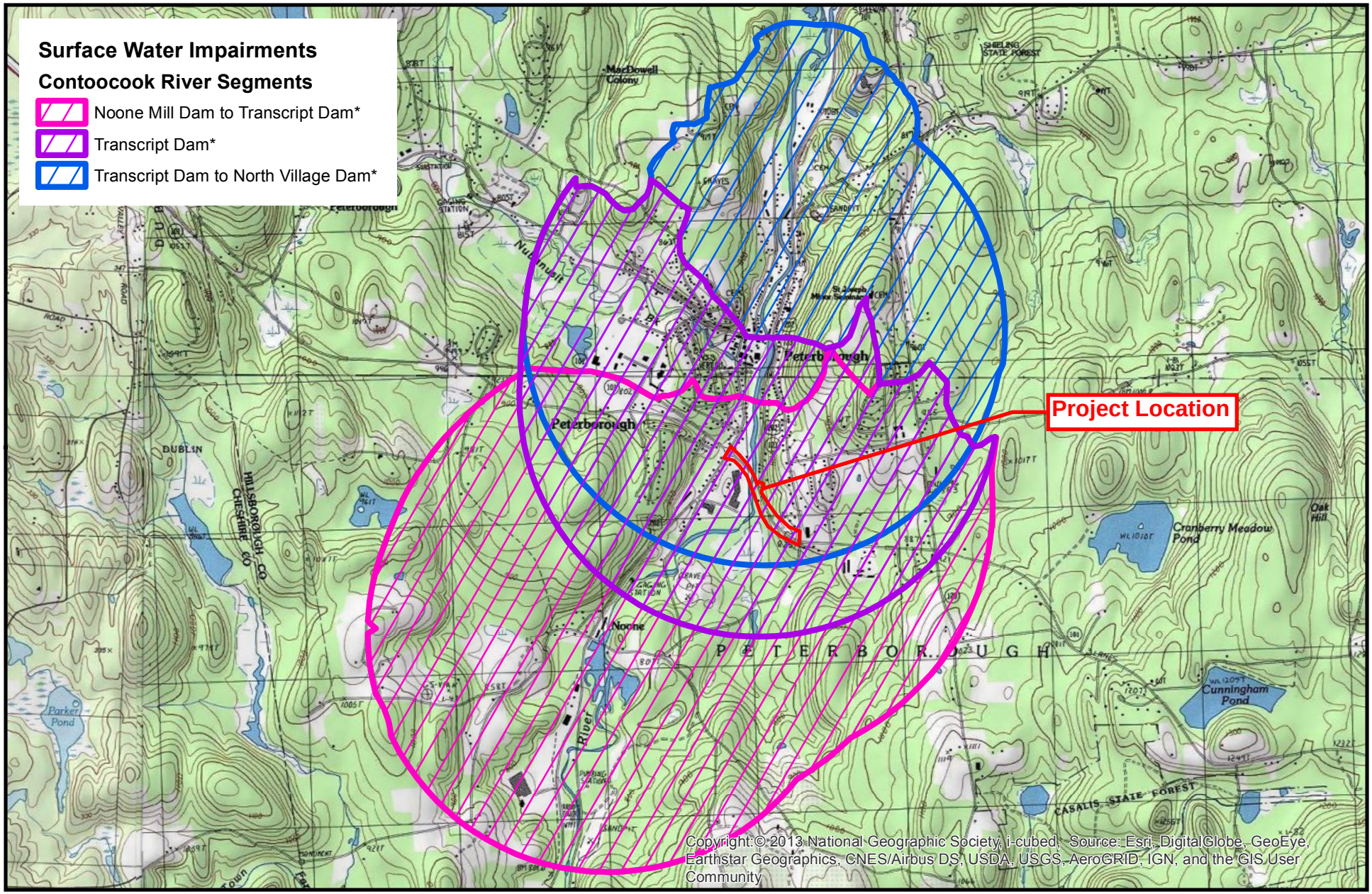
Project Locus Map

Surface Waters Impairment Map

Soils Map



Datum: NAD27



Hoyle, Tanner & Associates, Inc.
150 Dow Street
Manchester, NH 03101-1227
Tel 603-669-5555
Fax 603-669-4168
Web Page www.hoyletanner.com

SCALE
1 inch = 3,000 feet

DATE
7/29/2019

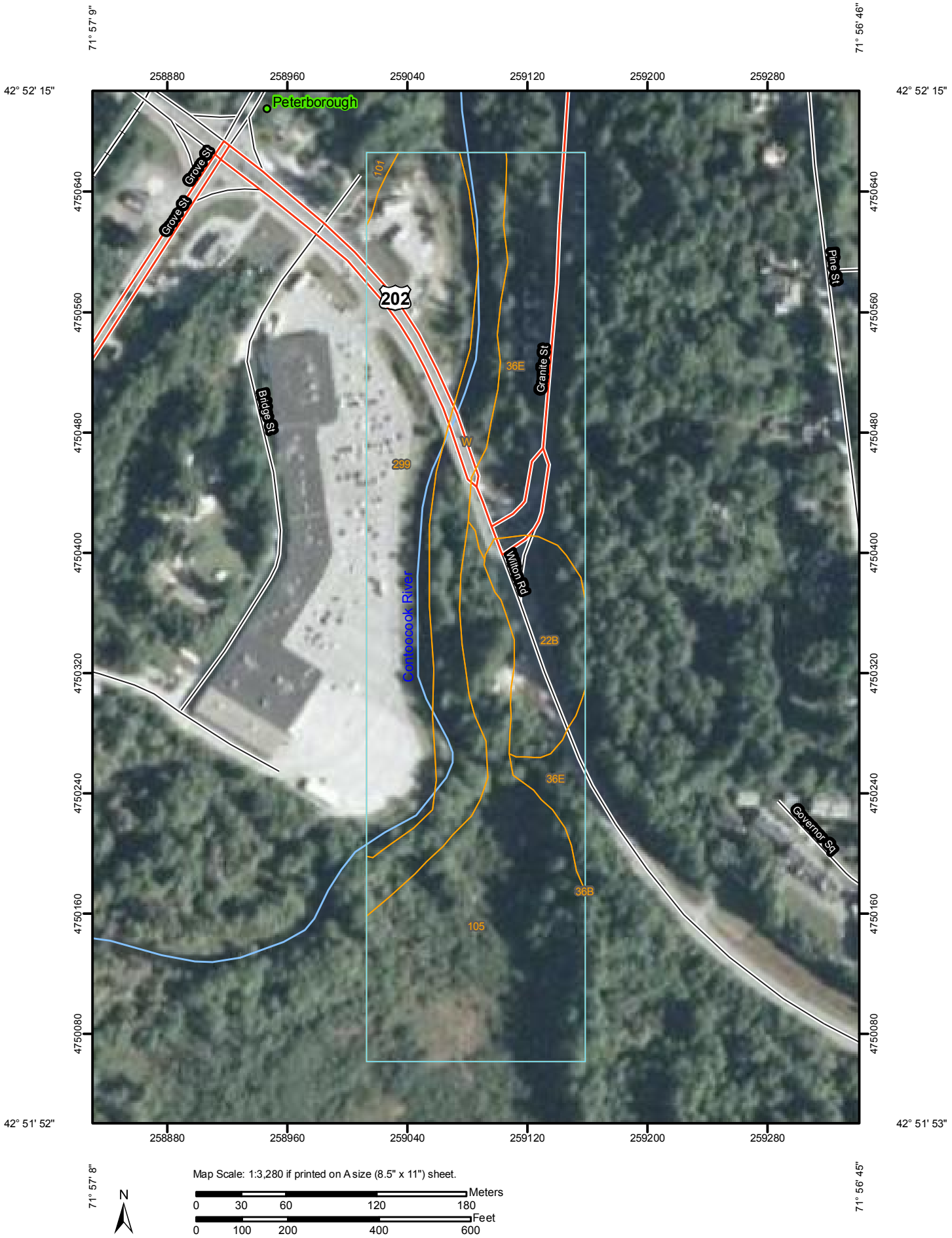
DR. BY
jtheriault

BRIDGE 087/077 REPLACEMENT PROJECT
NH ROUTE 101 OVER THE CONTOOCOOK RIVER
PETERBOROUGH, NH

SURFACE WATER IMPAIRMENTS MAP

*Impaired for Chlorophyll, Saturated Dissolved Oxygen, Dissolved Oxygen PPM, and Phosphorus

(19 Wilton Road, Peterborough, NH)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:3,280 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 19N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Hillsborough County, New Hampshire, Western Part
Survey Area Data: Version 11, Oct 27, 2009

Date(s) aerial images were photographed: 9/6/2003; 9/7/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Hillsborough County, New Hampshire, Western Part (NH602)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
22B	Colton loamy sand, 3 to 8 percent slopes	1.7	8.0%
36B	Adams loamy sand, 3 to 8 percent slopes	0.0	0.0%
36E	Adams loamy sand, 15 to 50 percent slopes	4.5	20.7%
101	Ondawa fine sandy loam	0.1	0.5%
105	Rumney loam	6.4	29.2%
299	Udorthents, smoothed	5.9	27.3%
W	Water	3.1	14.3%
Totals for Area of Interest		**21.7**	**100.0%**

Attachment B

Natural Resource Agency Coordination Meeting Minutes

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: April 18, 2012
LOCATION OF CONFERENCE: John O. Morton Building
ATTENDED BY:

NHDOT
Kevin Nyhan
Christine Perron
Matt Urban
Alex Vogt
Michael Hazlett
Michael Servetas
Wayne Roswell
Tim Mallette
Chris Carucci

NHDES Wetlands Bureau
Gino Infascelli
Lori Sommer

NHDES Air Resources
Felice Janelle

NH Fish & Game
Carol Henderson
Kim Tuttle

Army Corps of Engineers
Rich Roach

NH Natural Heritage Bureau
Melissa Coppola

NH Office of Energy and Planning
Jennifer Gilbert

CEI Engineering
Matt Lundsted

Hoyle, Tanner & Associates, Inc.
Stephen Haas
Matt Low

E.J. Prescott
Bill Varney

Jacobs Engineering
Luke Garrison
Ted Setas

HSI Engineering
John Vancor

FST
Bill Moore
David McNamara

Normandeau
Jamie Paine

ISCO Industries
Bob Kerr
Brian Zagrodny

(When viewing these minutes online, click on an attendee to send an e-mail)

PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH:
(minutes on subsequent pages)

(When viewing these minutes online, click on a project to zoom to the minutes for that project)

NOTES ON CONFERENCE:

Finalization of March Meeting Minutes

The March 21, 2012 meeting minutes were finalized.

Peterborough, 15879, X-A001(007)

Matt Low began the presentation by giving an overview of the proposed project. The goal of the project is to rehabilitate the US 202 and NH 101 bridge over the Contoocook River which is structurally deficient and is #57 on the NHDOT's Red list. The bridge, which was constructed in 1958, consists of 3 spans with 2 river piers and carries approximately 16,000 vehicles per day across the river. The bridge has one travel lane in each direction and a dedicated left turn lane for Granite Street. The bridge is in the 10 year plan for FY 2018 with a desired on-the-shelf date of late 2014. Hoyle Tanner has recently submitted and received comment from NHDOT on a 5% conceptual design for the bridge rehabilitation.

Matt Lundsted reviewed the photographs of the natural resources around the bridge and then provided an explanation of proposed bridge rehabilitation alternatives. The no-build option (Alt 1) was dismissed due to the structural deficiency of the bridge. A bridge replacement with a detour (Alt 2) was dismissed due to the impacts of high traffic volumes on local roads and other red-listed bridges such as the Main Street Bridge. A temporary bridge (Alt 3) was dismissed due to the increased environmental and right-of-way impacts. A bridge widening using phased construction (Alt 4) is considered to be the preferred alternative due the amount of impacts to traffic and the environment. A downstream widening (Alt 4B) is not preferred due to the location of existing utility poles, the Granite Street intersection, impacts to the adjacent gas station property and historic resources along Granite Street. An upstream widening (Alt 4A) with a minimal profile raise is preferred but there may be some permanent impacts to a pocket wetland at the existing toe of slope on the southeast corner. Options 5A and 5B are traffic control options at the Granite Street intersection consisting of a temporary traffic signal and a temporary roundabout. NHDOT has indicated that their preference is a temporary traffic signal.

M. Lundsted reviewed results of correspondence with the natural resource agencies. The NH Natural Heritage Bureau and US Fish and Wildlife Services do not have any records of sensitive or threatened species or habitats in the project area. NH Fish and Game has not yet provided comment. The NH Conservation Land Stewardship Program states that there are no LCIP properties in the area. The Contoocook is a designated river and the bridge is considered a Tier 3 crossing. The project is located within the floodplain and floodway of the Contoocook River and coordination with FEMA is required. It was noted that OEP has provided a response regarding floodplain impacts.

Kevin Nyhan asked if a full bridge rehabilitation with a traffic detour (Alt 2) would require bridge widening. M. Low indicated that the proposed widening is primarily for traffic control, however, the resulting wider bridge would be desirable to increase the insufficient shoulder width. K. Nyhan suggested discussing this in the purpose and need statement in the environmental document.

Rich Roach asked about the potential downstream dam removal for mitigating flood impacts. M. Low indicated that the Transcript Dam has no functional purpose and either needs to be repaired or removed. The Town has initiated coordination with Deborah Loiselle of the NHDES River Restoration program, but there is no proposal to remove the dam yet.

K. Nyhan suggested providing alternative slope treatments at the next Natural Resource meeting to review the permanent impacts to the wetland on the southeast quadrant of the bridge. Perhaps steeper slopes may limit impacts to the wetlands.

Gino Infascelli requested that Hoyle, Tanner investigate the possibility of providing stormwater treatment as part of the rehabilitation project. He also recommended contacting the Local Advisory Committee for the Contoocook River as soon as possible to solicit their concerns.

Carol Henderson questioned whether there was conservation land in the area. M. Lundsted stated that originally it was believed that there was but it has been confirmed that there is not. There is a shared use path, constructed with TE funding, that passes underneath the bridge; this path will be maintained.

This project has not been previously discussed at a Monthly Natural Resource Agency Coordination Meeting.

Nashua (Broad Street Parkway), 10040, NRBD-5315(21)

The purpose of this meeting was to update the group on the City of Nashua's Broad Street Parkway project as it progresses through final design and to receive resource agency input prior to permit application submittals. Dave McNamara provided a brief update of the project. FST and Normandeau are seeing the project through the Final Design and Permitting stages. The project is on the approximate same alignment that was considered during the recent environmental re-evaluation completed by others. The route would have one 11-foot wide lane in each direction. Existing railroad tracks are near the new Nashua River crossing, limiting crossing locations.

Jamie Paine stated that wetlands were field delineated this spring by certified wetlands scientists. Isolated wetlands are located within project corridor, predominantly north of the proposed river crossing. Several wetlands are anticipated to be impacted during construction. The river crossing is currently anticipated to have three spans with two piers in the river. River bank impacts are anticipated due to the construction of new bridge abutments. Wetland impacts are expected over a small portion of the canal located within the mill yard. Preliminary loading analysis has been completed to review stormwater issues. Three detention ponds with pretreatment (bio-retention) are proposed.

Rich Roach asked about floodplain impacts and if there would be any floodplain mitigation. The response was that the project team is currently looking into the floodplain impacts and the quantity of impact is not yet known.

Carol Henderson asked if the project was out of the river except for steep banks. It was stated that piers would be in the river at the new bridge crossing. Abutments would be set back behind the current stone walls.

Gino Infascelli commented that when the project was last presented at the Natural Resource Agency Meeting in February 2010, wetland impacts were 0.4 ac. He asked for an update on wetland impacts. J. Paine replied that a full field delineation has now been completed. The impact area, including ground disturbance within the prime wetland buffer, is 0.8 acre (including 25,000 sq ft pocketed wetlands and 10,000 sq ft associated with piers in the river). The Nashua Conservation Commission is familiar with the project.

R. Roach asked about the timeline for submitting permit applications. J. Paine stated that they anticipate submitting permit applications in June 2012.

Lori Sommer asked if mitigation was planned. She noted that a meeting should be scheduled with NHDES prior to application submittal, and that Normandeau should talk to the city to find out what is available for mitigation options. NHDES needs a preliminary idea of what is being considered for mitigation prior to the applications being submitted. J. Paine explained that on-site and in-lieu fee options are being considered

BUREAU OF ENVIRONMENT
CONFERENCE REPORT

SUBJECT: NHDOT Monthly Natural Resource Agency Coordination Meeting
DATE OF CONFERENCE: August 15, 2012
LOCATION OF CONFERENCE: John O. Morton Building
ATTENDED BY:

NHDOT
Christine Perron
Marc Laurin
Matt Urban
Jon Evans
Pete Stamnas
Mike Servetas
Joshua Lafond
Chris Girard
Kathy Corliss
Amy Lamb
Peter Salo
Mark Hemmerlein
Samantha Fifield
Ron Grandmaison
Dan Prehemo

NHDES
Gino Infascelli
Lori Sommer

Army Corps of Engineers
Rich Roach

EPA
Mark Kern

NH Fish & Game
Carol Henderson

Southern NH Planning Commission
Adam Hlasny

CLD Engineers
John Byatt

Smart Associates
Jennifer Riordan

Hoyle, Tanner & Associates
Todd Clark
John Mirabito
Matt Low
Steve Haas

Comprehensive Environmental, Inc.
Matt Lundsted

Jacobs Engineering
Aaron Seaman
Ted Setas

(When viewing these minutes online, click on an attendee to send an e-mail)

PRESENTATIONS/ PROJECTS REVIEWED THIS MONTH:
(minutes on subsequent pages)

(When viewing these minutes online, click on a project to zoom to the minutes for that project)

In addition, the Town of Hampton intends to replace sanitary sewer pipes and structures in advance of the roadway activities proposed under this project.

No wetlands will be impacted by the proposed activities. Based on response letters from the NH Natural Heritage Bureau and US Fish and Wildlife Services, there are no records of sensitive or threatened species or habitats in the project area. There are no LCIP properties in the area. The project is not located within the floodplain.

No concerns were raised at the meeting.

This project has not been previously discussed at a Monthly Natural Resource Agency Coordination Meeting.

Peterborough, 15879, X-A001(007)

Matt Low began the presentation by noting that the project was originally presented at the April 2012 Natural Resource Agency meeting, and he recapped the goal of the project, which is to rehabilitate the US 202 and NH 101 bridge over the Contoocook River. The bridge is structurally deficient and is #57 on the NHDOT's Red list. There were three concerns expressed at the previous meeting, which included minimizing wetland impacts on the southeast corner of the bridge, evaluating the potential for stormwater treatment, and soliciting feedback from the Contoocook River Local Advisory Committee. The project was presented at a Public Informational Meeting in May 2012 for the Town of Peterborough, at which time there was a request from the town to incorporate a sidewalk on the bridge. To accommodate this request, Hoyle, Tanner reduced the shoulder width on the bridge to incorporate a sidewalk on the upstream (north) side, but there will still be minor increases in slope impacts on either approach. The bridge widening remains the same as was presented before as the sidewalk was added by reducing the shoulder widths on each side of the roadway.

Matt Lundsted reviewed how the concerns raised at the previous meeting had been addressed:

1. The impacts to the low quality wetland on the southeast corner of the bridge can be minimized by installing a 1.5:1 stone slope along this portion of the roadway.

2. Three areas were evaluated for their potential to treat stormwater.
    - A treatment swale located on the southwest corner of the bridge could provide some level of treatment, although it may not meet all the requirements of the Alteration of Terrain permit rules.
    - An infiltration trench has been proposed on the eastern corner of NH 101 and Granite Street. However, recently received right-of-way and utility information may require modifications that may limit the BMP's ability to provide full treatment. An infiltrating catch basin located within the State's ROW may be investigated in this location.
    - An infiltrating catch basin has been proposed within the raised island on Granite Street. This BMP will treat 0.30 acres of impervious surface. As this is larger than the proposed increase in impervious area (0.28 acres), any treatment that can be gained from other BMP's on the project is seen as an improvement in the quality of stormwater runoff over the existing condition.

3. M. Lundsted met on site with Contoocook River LAC. Their concerns were with debris falling into the river from construction activities and construction access to perform the pier widenings. M. Lundsted informed the LAC that the bridge would be planked between girders to prevent debris from entering the river and that construction would be performed either from the river bank or from

above. The committee will discuss these issues at their next meeting but no further concerns are expected.

Rich Roach questioned the benefit of avoiding the low quality wetland by installing a steepened stone slope that may not be aesthetically pleasing and could increase runoff temperature. M. Lundsted noted that there may be a view of the slope from the plaza but felt aesthetics would not be a concern as the bridge would be the focal point and vegetation along the river may obstruct views. Gino Infascelli noted that the existing wetland is probably providing some level of treatment. M. Low noted that the proposed impact to this wetland with a 2:1 slope would be approximately 1,000 to 2,000 sf. R. Roach noted that he would leave it up to local project participants to decide whether the wetland should be impacted.

Carol Henderson asked if the Natural Heritage Bureau had any concerns. M. Lundsted noted that no concerns were indicated.

C. Henderson asked when the project would be constructed. M. Low indicated that the project will be on the shelf (ready for bid) in 2014 but is not slated for construction until FY 2018. C. Henderson noted that her concern would be the time of year that cofferdam work was done. She indicated that this work should be done after the fish spawning season. The Contoocook River does carry trout populations. M. Low responded that the construction scheduling and phasing of any river work can be detailed in the permits eventually obtained for the project.

This project was previously reviewed on the following dates: 4/18/2012.

Rochester, 20254, X-A002(056)

Ted Setas gave an overview of the project, which involves the design of a proposed Park and Ride facility with a capacity for 197 vehicles as well as a concrete platform for a future bus shelter (kiosk) facility. The proposed Park and Ride will be accessed at three points from a currently private drive (Highfield Commons Drive). The drive joins US Route 202 (Washington Street) approximately 2,000 feet west of the Spaulding Turnpike Interchange 13.

When previously presented, this project consisted of 225 parking spaces with porous pavement. During the final design process it was determined that the soil conditions for the site are not suitable for porous pavement. The design has been revised to include porous pavement in the southernmost parking area, underground detention in the bus stop area, and a detention area in the northernmost parking area. T. Setas presented the grading plan and described the grading of the detention area.

The wetland impacts were summarized as follows:

Existing Wetland Area: 12,840 Sq. Ft. (0.29 Acres)
Impacted Wetland Area: 11,753 Sq. Ft. (0.27 Acres)
Remaining Wetland Area: 1,087 Sq. Ft. (0.02 Acres)

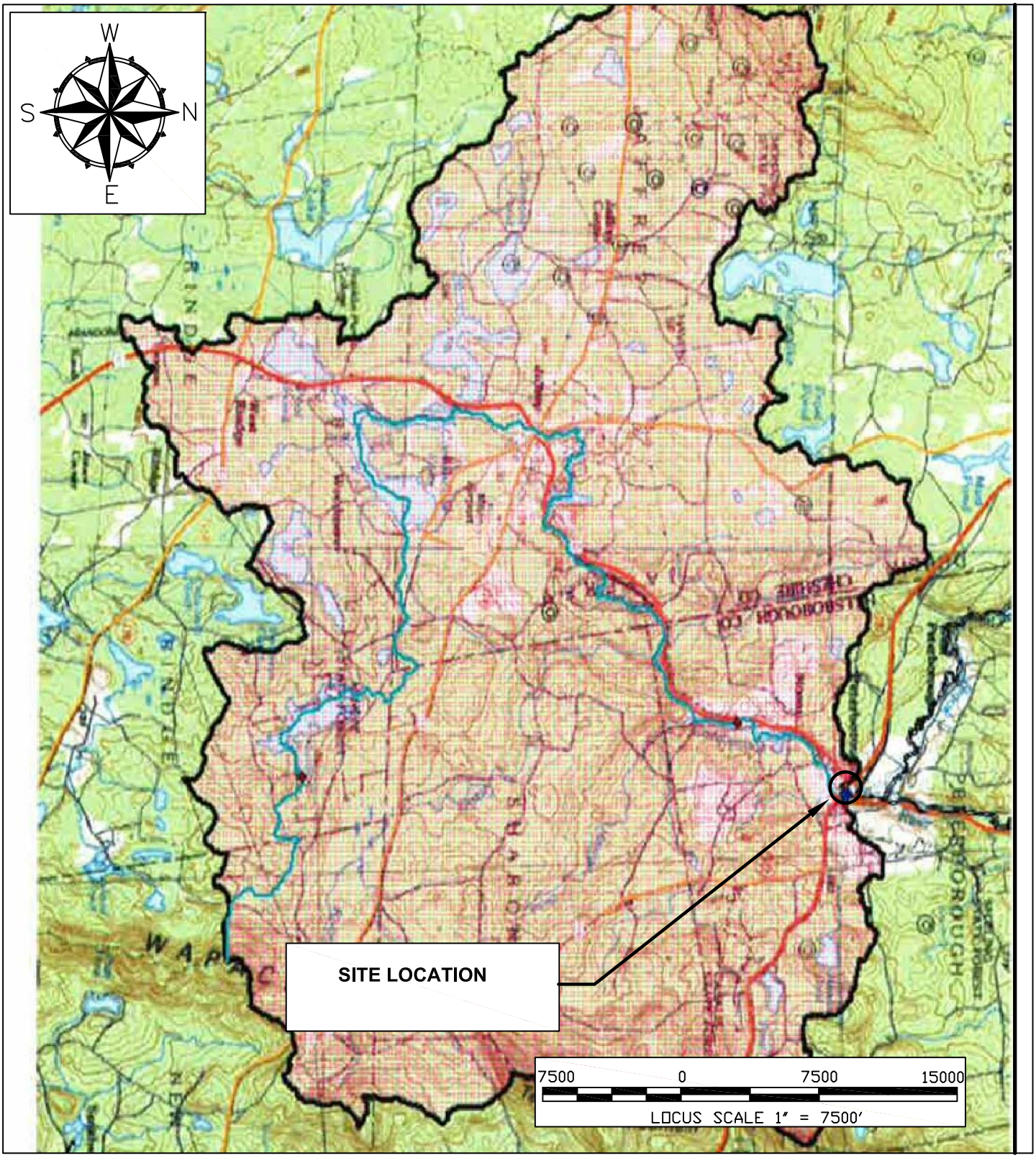
Lori Sommer asked if the existing wetland on site was forested wetland. T. Setas confirmed that it is forested wetland.

Carol Henderson asked why the wetland was being filled to an elevation of 265'. T. Setas explained that the slopes extending to existing ground do not give much area for preserving existing wetland and does not provide for maintenance access for the basin.

Rich Roach asked about the size of the detention area. T. Setas stated that the area was approximately 100 feet by 100 feet. Christine Perron asked if the wetland impacts were only necessary because of the detention area. T. Setas stated that impacts to the wetland are also from slopes of the parking area and entrances. R. Roach indicated that mitigation was needed given that wetland impacts exceed 10,000 sq. ft.

Attachment C

USGS with Watershed Boundaries Area for Stream Crossings



GENERAL NOTES

1. WATERSHED MAP BASED ON NH USGS STREAMSTAT IMAGE.
2. LOCUS SCALE IS APPROXIMATE

TOWN OF
Peterborough
New Hampshire

US Route 202/NH Route 101 Bridge Replacement
USGS Watershed Map

COMPREHENSIVE ENVIRONMENTAL INCORPORATED
21 DEPOT STREET
MERRIMACK, NH 03054

Attachment D

Stream Crossing Evaluation

NH Department of Transportation
Bureau of Environment
Peterborough #1789

Stream Crossing Requirements

The proposed project includes replacement of an existing Tier 3 stream crossing over the Contoocook River with a bridge that is slightly widened to improve safety issues. This structure has been designed to meet the NH Wetlands Rules, Env-Wt 900 Stream Crossings, to the extent practicable as noted below, however, because the proposed bridge will include a single pier (where two piers currently exist) and will not be a span structure, an Alternative Design request is included.

Env-Wt 904.05 Design Criteria for Tier 2 and Tier 3 Stream Crossings. New tier 2 stream crossings, replacement tier 2 stream crossings that do not meet the requirements of Env-Wt 904.07, and new and replacement tier 3 stream crossings shall be designed and constructed:

(a) In accordance with the NH Stream Crossing Guidelines, University of New Hampshire, May 2009, which can be downloaded for free at http://des.nh.gov/organization/divisions/water/wetlands/documents/nh-stream-crossings.pdf;

The replacement crossing has been designed to meet the Stream Crossing Guidelines to the maximum extent practicable. As detailed in the Geomorpholoy Report (attached), the widths of the existing and proposed spans are wider than the bankfull channel and the proposed crossing is compatible with the current stream type, C4. The proposed crossing will not meet the entrenchment ratio requirement; meeting this is impracticable in this location.

(b) With the bed forms and streambed characteristics necessary to cause water depths and velocities within the crossing structure at a variety of flows to be comparable to those found in the natural channel upstream and downstream of the stream crossing;

The proposed replacement structure will not substantially alter the existing conditions with respect to bed forms, streambed characteristics, water depths or velocities within the crossing and will function similarly to the upstream and downstream natural channel conditions. The proposed design includes removing the existing two piers and installing a single open pier that is located more toward the center of the channel; this will improve streambed characteristics and bank stability when compared to existing conditions because the current location of piers may be directing erosional forces onto the existing banks (due to the proximity of the current piers to the banks). The impact to the streambed has been minimized to the extent practicable and is necessary for stabilization of the new abutment/wingwall on the west side.

(c) To provide a vegetated bank on both sides of the watercourse to allow for wildlife passage;

The bridge will not contain vegetated banks within the structure, however vegetated banks exist on each side of the river and on each side of the road/crossing that will only be temporarily disturbed. A paved footpath approximately 8' wide exists beneath the bridge on the west side

and will remain after construction is completed. Wildlife can use this path to safely cross under the bridge instead of crossing the road. Widening the bridge to allow for vegetated banks within the structure would substantially increase impacts and would be cost-prohibitive for the project as there would have to extensive regrading and additional road work to install such a structure. At all but the highest of flows, there will be sufficient wildlife travel-way through the corridor.

(d) To preserve the natural alignment and gradient of the stream channel, so as to accommodate natural flow regimes and the functioning of the natural floodplain;

The natural alignment and gradient of the stream channel will be preserved in this location within the proposed crossing to accommodate natural flow regimes and the functioning of the natural floodplain to the extent practicable.

(e) To accommodate the 100-year frequency flood, to ensure that:
(1) There is no increase in flood stages on abutting properties; and
(2) Flow and sediment transport characteristics will not be affected in a manner which could adversely affect channel stability;

Hydraulic analysis was completed and is detailed in the Geomorphology Report. The analysis indicates the structure accommodates the 100-year storm event and there will be no increase in base flood elevations as a result of the project. Flow and sediment transport characteristics will not be affected.

(f) To simulate a natural stream channel; and

The proposed crossing will not substantially alter the existing stream channel.

(g) So as not to alter sediment transport competence.

Sediment transport competence will improve as a result of the shift in pier location.

Alternative Design

A Tier 3 crossing requires either an open-bottomed culvert or a span structure, per Env-Wt 904.04(d). A span structure was analyzed during design review and was determined to not be practicable in this location. A span structure would require installation of substantially deeper girders to carry the single span and allow for the required depth to accommodate the 100-year flood flows. This would result in substantial regrading of NH Route 101 east and west of the bridge, including redesign of the intersection with NH Route 202. These additional measures would increase the cost of the project beyond what is feasible for the Department and the Town to provide.

A replacement stream crossing must be adequately dimensioned based on the entrenchment ratio of the stream within the natural range of variability for the stream type such that the width of the replacement bridge be at least equal to the bankfull width times the entrenchment ratio of the stream crossing. To meet this guideline, the proposed replacement structure would require a replacement structure of a size that is not practicable and beyond the scope of the project.

The proposed structure provides an improved geomorphic setting in this location by removing the two piers and replacing them with a single open pier that will result in a reduction in streambed fill/impact of approximately 95 square feet.

This application hereby requests an alternative design be approved for this project per the criteria in Env-Wt 904.09(c) as follows: 1) adhering to the design criteria is not practicable as noted above; 2) the proposed design meets the criteria specified in Env-Wt 904.05 and Env-Wt 904.08 Replacing Tier 3 Existing Legal Crossings to the maximum extent practicable; and, 3) the proposed design meets the general design criteria specified in Env-Wt 904.01 as follows:

The stream crossing as designed will not be a barrier to sediment transport;

will not prevent the restriction of high flows and will maintain low flows;

will not obstruct or disrupt the movement of aquatic life beyond the duration of construction;

will not cause an increase in the frequency of flooding or overtopping of banks;

will preserve watercourse connectivity;

will not cause erosion, aggradation or scouring upstream or downstream of the crossing; and

will not cause water quality degradation.

Mitigation

Compensatory mitigation is not required for replacement Tier 3 structures that are determined to be self-mitigating. The proposed structure will remove two piers from the Contoocook River and replace them with a single open pier that has a reduced footprint in comparison. The area of proposed permanent impact along the west bank will be the result of riprap placed along a section of bank that has been historically composed of riprap in order to stabilize and protect the abutment and footpath under the bridge. Some of the stones have been removed or fallen into the river over time, thus, the riprap will be replaced to meet current standards. The impact is identified as permanent because addition of stone fill is considered “permanent fill” by NHDES, however, upon project completion, this section of bank will function as it currently does, thus, there is no mitigation proposed to compensate for a loss of function or value to this bank.

September 9, 2013

Matt Lundsted, P.E., CFM
Comprehensive Environmental Inc.
21 Depot Street
Merrimack, NH 03054
(800)72-2550 x305
mlundsted@ceiengineers.com

Subject: NH Route 101 over the Contoocook River, Peterborough, NH
Summary Report on River Surveys and Fluvial Geomorphology

Mr. Lundsted:

We have completed river surveys and data collection in the vicinity of the NH Route 101 Bridge over the Contoocook River in Peterborough. The data has been used to assess fluvial geomorphology and prepare a HEC-RAS geometry file for your use in modeling hydraulic conditions in the vicinity of the crossing. As part of the geomorphic assessment we also estimated peak flood flows at the site. The methods and results of our study are presented below and supporting documentation is included in the appendices.

1. Hydrology

The drainage area of the Contoocook River at the Route 101 Bridge is approximately 72.1 square miles (see Watershed Delineation in Appendix 1). USGS Gage No. 01082000 (Contoocook River at Peterborough, NH) is located approximately 4,350' (0.8 miles) upstream from the bridge. The watershed area at the gage is 68.1 square miles, or about 94% of the drainage area at the bridge. Flows have been recorded at the gage continuously since 1946, yielding a 64 year period of record. Annual peak discharge data from the gage was used to perform a flood frequency analysis using the Bulletin 17B method[1]. Results of the flood frequency analysis are summarized in Table 1 along with the peak flows published in the FEMA Flood Insurance Study (FIS) at the gage.

Figure 1 – View west toward the Contoocook River at USGS Gage No. 01082000 (8/19/13)

[1] Interagency Advisory Committee on Water Data (1982). Guidelines for determining flood flow frequency, Bulletin 17B, U.S. Department of the Interior, U.S. Geological Survey, Office of Water Data Coordination, Reston, VA.

Table 1 – Flood Frequency and FIS Flows at USGS Gage No. 01082000

Recurrence Interval (years)	Instantaneous Peak Discharge (cfs)	
	Flood Frequency Analysis	FEMA FIS
1.01	514	-
1.5	1092	-
2	1315	-
10	2360	2300
50	3439	4310
100	3945	5700

Due to the similarity in drainage areas, it is reasonable to assume that peak flows at the bridge are similar to those at the gage; however, as shown in Table 2, flood levels published in the FIS between the gage and confluence with Nubanusit Brook were based on higher flows than those listed in Table 1.

Table 2 –FIS Flows between USGS Gage No. 01082000 and Confluence of Nubanusit Brook

Recurrence Interval (years)	Instantaneous Peak Discharge (cfs)
10	2660
50	4990
100	7150
500	11430

There are several upstream dams and reservoirs which appear to affect flows at the gage and bridge. These are summarized in Table 3.

Table 3 – Upstream Dams and Reservoirs

Dam/Reservoir Name	NH Dam No.	Drainage Area (sq. mi.)	Impoundment Area (ac)	Use
Mountain Brook Reservoir	124.17	14.0	110	Recreation
Contoocook Lake (Red Dam)	124.02	14.3	380	Recreation
Cheshire Pond (Cheshire Pond Dam)	124.04	35.5	57	Hydroelectric
Noone Mill Dam	191.02	68.0	20	Hydroelectric

Although none of these dams is specifically operated for flood control, they likely have some effect on peak flows; particularly lower magnitude, higher frequency floods where the storage volume is significant relative to the runoff volume. This is supported by comparisons between the bankfull discharge predicted by the NH and VT Regional Hydraulic Geometry Curves and the flood frequency results.

Table 4 – Comparison between Predicted Bankfull Discharges and Flood Frequency Results

Method	Predicted Bankfull Discharge at Gage (cfs)	Corresponding Recurrence Interval (years)
NH Curves	2014	6
VT Curves	1619	3

The bankfull, or channel-forming, flow typically has a recurrence interval of between 1.2 and 1.7 years. As shown in Table 4, the recurrence interval of the bankfull discharge values predicted with the regional curves is between 3 and 6 years. This suggests that for its watershed size, the bankfull discharge is less than what would typically be expected. It is likely that flow regulation contributes to these lower than average discharges.

The bankfull discharge was calibrated at the gage by determining the stage corresponding to reliable field indicators of the bankfull stage and using the gage rating curve to determine the corresponding discharge. A narrow, level active floodplain bench (~8' wide) is located along the right bank across from the gage intake. The elevation of this feature is the same as the top of the low riverbank on the left side of the channel. The active floodplain bench is a reliable indicator of the bankfull elevation and corresponds to a stage of 3.25 (relative to the gage datum) and a discharge of 535 cfs. The recurrence interval of this flow is approximately 1.02 years. This recurrence interval is significantly lower than what would be expected on an unregulated stream. It appears that flow regulation has changed the dominant hydrologic and sediment regime such that the channel dimensions have adjusted to a lower magnitude, higher frequency bankfull flow.

Figure 2 – View east across Contoocook River at USGS Gage No. 01082000 showing active floodplain bench along far right bank indicative of the bankfull stage (8/19/13)

Supporting calculations, exhibits, and documentation related to the hydrologic analyses are included in Appendix 1.

2. River Surveys and Data Collection

Our field surveys and data collection were completed between August 15th and 20th, 2013 during normal low flow conditions. Water levels fluctuated by as much as about 6" on a daily basis in response to releases from the upstream hydroelectric facilities.

Survey and data collection included:

- 10 valley-wide cross-sections;
- 2 internal bridge cross-sections;
- Longitudinal channel profile covering approximately 1,720' of the river; and
- Pebble count

With the exception of the furthest upstream cross-section, all survey measurements were made relative to the survey control established by NHDOT. Elevations are relative to NAVD88 and the horizontal grid is NAD83, NH State Plane. The furthest upstream section is located at the USGS gage. Elevations at that section were made relative to the local gage datum and its position was captured with a mapping grade GPS unit relative to NH State Plane.

The sections are labeled numerically based on the cumulative stream distance above the furthest downstream cross-section, just upstream from the confluence with Nubanusit Brook, which is labeled "XS 5000". For example XS 6287 is located 1,287' upstream from XS 5000.

The locations of the sections at the upstream end of flow contraction and downstream end of flow expansion (cross-sections 7921 and 6287, respectively) were estimated using the average width of the valley bottom obstructed by the bridge approaches (500'±) and contraction and expansion ratios of 1:1 and 2:1, respectively. Additional cross-sections were surveyed between the bridge and XS 7921 for the geomorphic assessment, but should not be used in the hydraulic model unless it is determined that there is no flow in the left overbank area. The cross-section locations are shown on the "Cross-Section Layout Plan" in Appendix 2.

Four cross-sections were surveyed at the bridge – one each along the upstream and downstream toe of the highway embankment and one each just inside the upstream and downstream face of the bridge. These sections were surveyed parallel to the highway, which is skewed approximately 45° to the river. The cross-section stationing in the hydraulic model must be adjusted to account for the skew. The sections beneath the superstructure are intended to be used as internal bridge sections in the model. We also measured dimensions of the piers and low chord elevations at both ends of the bridge.

The longitudinal profile was surveyed along the thalweg, or deepest portion of the channel, between XS 6287 and XS 7957. Elevations of the thalweg, water surface, bankfull flood stage indicators, and recently abandoned floodplains (RAFs) were captured along the profile alignment shown on the "Plan and Profile" drawing in Appendix 2.

A zigzag pebble count was performed in the vicinity of the bridge. 100 particles from the riverbed and lower banks were randomly sampled and measured. No imported particles (e.g. riprap) were sampled. The data was used to develop the particle size distribution in Appendix 2.

3. Fluvial Geomorphology

Our assessment of fluvial geomorphology included evaluations of surficial geology and valley characteristics; channel dimension, pattern, profile, and materials; stream types; riparian vegetation buffers, and channel stability. In general, we found that the Contoocook River at the crossing is an incised alluvial channel which has departed from its reference stream type.

3.A. Surficial Geology and Valley Morphology

Figure 2 – Erodible alluvial bank adjacent to commercial plaza parking lot upstream from bridge (8/16/13)

The NRCS Hillsborough County Soil Survey indicates that the valley bottom in the vicinity of the crossing is covered by disturbed land (Udorthents, 299), where the original soil was removed or filled over, and alluvial soils – Ondawa fine sandy loam (101) and Rumney loam (105). Udorthents are mapped along the west side of the river where the commercial plaza and gas station are now located. It is likely that these were historically alluvial soils. The valley walls near the crossing are covered by outwash soils – Colton loamy sand (22) and Adams loamy sand (36). In general, the soils forming the channel boundaries are erodible. The Soils and Geologic Materials Map in Appendix 2 shows the soil and parent material mapping in the project area.

The brook flows through a broad, low gradient valley at the bridge site. The crossing is located in an area where the valley is narrowing from about 1,000' wide at the bridge to approximately 300' at XS 6287. The valley slope is about 0.23%.

The surficial geology and valley morphology in the vicinity of the bridge are typically associated with C and, less commonly, E stream types.

3.B. Channel Cross-Section

Ten valley-wide cross-sections were surveyed between the confluence with Nubanusit Brook, about 2,450' downstream of the bridge, and the USGS gage approximately 4,350' upstream from the bridge. Plots of the sections are included in Appendix 2 along with photos of the channel at the sections.

Figure 3 – View upstream of Contoocook River at XS 7757 (8/16/13)

The sections at the bridge (XS 7239 and XS 7374) are intended for use only in the hydraulic model. XS 7757 was used in the geomorphic assessment and should be used in the model only if there is no flow in the left overbank. XS 7435 was used in the geomorphic assessment but, due to its proximity to the bridge, it should not be used in the model. The section at the gage (XS 11679) was used to calibrate the bankfull discharge, stage, and channel dimensions but, since it was not surveyed relative to the same vertical

datum as the other sections, it cannot be used in the model. All other sections were used in the geomorphic assessment and should be used in model. Table 5 summarizes the channel and valley geometry measured at the cross-sections.

Table 5 – Measured Channel and Valley Geometry

Cross-Section	Bankfull XS Area (sf)	Bankfull Width (ft)	Mean Bankfull Depth (ft)	Width to Depth Ratio	Max. Bankfull Depth (ft)	Width Flood Prone Area (ft)	Entrench Ratio	Incision Ratio
5000	527	149	3.5	43	5.9	319	2.1	1.7
6287	392	91	4.3	21	6.0	149	1.6	1.7
7435	196	56	3.5	16	5.6	100	1.8	2.5
7757	233	60	3.9	15	5.2	168	2.8	1.5
7921	357	67	5.3	13	7.0	129	1.9	1.4
7957	202	68	3.0	23	5.7	103	1.5	2.2
9485	276	105	2.6	40	4.5	1700	16.2	1.6
11679	204	70	2.9	24	3.9	122	1.7	1.8
Average Values	*298*	*83*	*3.6*	*24*	*5.5*	*349*	*3.7*	*1.8*

As indicated in Table 5, there is considerable variability in the channel dimensions measured at the cross-sections. This is in part due to human channel alterations, the effects of Transcript Dam (located about 3,100' downstream of the bridge), bedforms at the sections (e.g. riffle, pool), or channel instability. Representative channel dimensions should be measured at riffle or run bedforms where the channel is free to adjust its boundaries and reasonably stable (i.e. neither aggrading, degrading, or rapidly widening). Only four of the cross-sections satisfy these criteria (7435, 7757, 7957, and 11679). Table 6 summarizes the geometry measures at these sections. The average values are considered representative of the natural channel cross-sectional geometry at the bridge.

Table 6 – Representative Channel and Valley Geometry

Cross-Section	Bankfull XS Area (sf)	Bankfull Width (ft)	Mean Bankfull Depth (ft)	Width to Depth Ratio	Max. Bankfull Depth (ft)	Width Flood Prone Area (ft)	Entrench Ratio	Incision Ratio
7435	196	56	3.5	16	5.6	100	1.8	2.5
7757	233	60	3.9	15	5.2	168	2.8	1.5
7957	202	68	3.0	23	5.7	103	1.5	2.2
11679	204	70	2.9	24	3.9	122	1.7	1.8
Average Values	*209*	*64*	*3.3*	*20*	*5.1*	*123*	*2.0*	*2.0*

As shown in Table 6, channel dimensions are relatively similar at these sections. Of particular interest are the incision and entrenchment ratios. The incision ratios, which are calculated by dividing the maximum depth to the lowest adjacent RAF by the

maximum bankfull depth, indicate that the channel is moderately to deeply incised such that there is no access to broad floodplains at flows just above bankfull. As a result, the entrenchment ratios, calculated as the flood prone width divided by the bankfull width, are much lower than would be expected for streams in broad alluvial valleys. For this reason the channel dimensions shown in Table 6 are considered "representative" rather than "reference", the latter being the dimensions which would likely exist in the absence of human-related changes to the channel, floodplain, and/or watershed. We were unable to locate any reference channel segments in the study area.

The bankfull channel geometry at the project site was also predicted using the 2005 NH and 2006 Vermont Regional Hydraulic Geometry Curves, which relate bankfull channel dimensions (cross-sectional area, width, and mean depth) to drainage area. Table 7 provides a comparison of the measured bankfull geometry and the bankfull geometry predicted by the NH and Vermont Regional Curves.

Table 7 – Predicted and Measured Bankfull Cross-Sectional Geometry

Variable	Average Measured Value (representative sections)	Predicted Value	
		NH Curves	VT Curves
Bankfull XS Area (sf)	209	372	293
Bankfull Width (ft)	64	94	84
Mean Bankfull Depth (ft)	3.3	4.0	3.4

As shown in Table 7, the average channel dimensions measured at the representative cross-sections are considerably smaller than those predicted by the Regional Curves. This is consistent with the lower than expected bankfull discharge and suggests that: (1) for its watershed size, the channel is smaller than what would typically be expected and (2) flow regulation may have led to the diminution in the size of the bankfull channel.

3.C. Channel Pattern

The Contoocook River has a relative straight alignment in the project area. The sinuosity of the channel between XS 5000 and XS 9485 is approximately 1.08, indicating that the channel is about 8% longer than its valley over that reach. This is a low value for a stream located in a broad, low gradient, alluvial valley and is due, in part, to past channel straightening in the immediate vicinity of the bridge.

Aerial photography from 1947 (see Figure 4) shows that a prominent meander bend was formerly located in the vicinity of the crossing and the bridge was located about 500' northwest of the existing bridge, near the present-day westerly gas station entrance. The 1947 channel alignment and

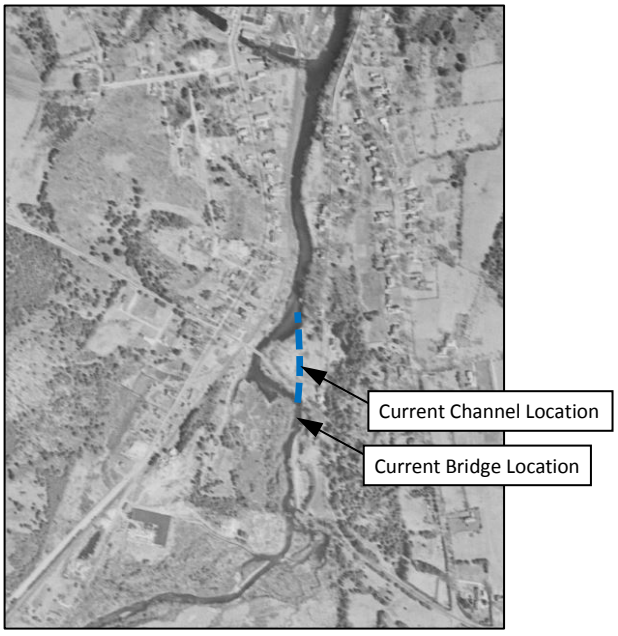


Figure 4 – 1947 aerial photograph

bridge location are shown on the "Cross-Section Layout Plan" in Appendix 2.

It appears the river was straightened in conjunction with highway improvements and construction of the bridge in its current location. Aerial photography from 1960 shows the river and bridge in their present locations; therefore, we can conclude the river was straightened sometime between 1947 and 1960. The straightening reduced the channel length by about 300' in the vicinity of the crossing and was the principal factor in lowering the sinuosity between XS 5000 and XS 9485 from approximately 1.13 to its present-day value of 1.08.

Other than a single meander sequence between the gage and XS 9485, there are no fully developed meander bends in the study area. What meanders there are have a large radius and narrow belt width. As previously described, the absence of significant meander bends is partly due to physical channel straightening, but is also likely attributable to the incised river condition as incising rivers are prone to meander avulsions during flood events. Indeed, there are several abandoned meander bends in the vicinity of the bridge which can be observed in the field and on historic aerial photography.

Although the highway and bridge deck are skewed to the river, the piers and abutments are more or less perpendicular to the current channel alignment.

3.D. Channel Profile

The longitudinal profile covers approximately 1,720' of the river, or approximately 11.5 times the largest measured bankfull width (149' at XS 500). The profiled river reach begins about 1,030' downstream of the bridge and ends approximately 690' upstream of the crossing. The profile is plotted on the "Plan and Profile" drawing in Appendix 2.

Backwater created by Transcript Dam (located just upstream from Main Street about 3,100' downstream of the Route 101 Bridge) significantly affects low flow water levels and depths in the vicinity of the crossing. As a result, using the average measured water surface slope along the profile as an estimate of the channel slope is unreliable. A deposit of large boulders at XS 7957, near the upstream end of the profile, controls the riverbed grade. The effects of the dam on low flow water levels upstream from this grade control feature are not significant. Therefore, the average water surface slope was measured between this point and the next upstream cross-section (XS 9485), a stream length of about 1,530'. The resulting slope was 0.28%. By comparison, the average water surface slope measured between XS 6287 and XS 7921 was only 0.04%.

Figure 5 – View upstream at boulder grade control at XS 7957 (8/16/13)

The river along the profiled reach has a gradually undulating somewhat featureless plane bed. Plane bed forms such as these are characteristic of incised alluvial streams where increased stream power has eroded the riffles which would typically be found in riffle-pool streams. Only one distinct riffle was found, about 600' downstream from the bridge where the river is overly wide and aggrading. The only other prominent bed feature is the aforementioned boulder grade control at XS 7957, which appears to be a manmade feature.

Perhaps the most notable feature along the profile is the recently abandoned floodplain (RAF) which varies from about 2.6' above the bankfull stage at the upstream end of the profile to approximately 3.6' above bankfull at the downstream end. The separation between the bankfull stage and RAF elevation along the length of the profile confirms that channel incision is a systemic, rather than isolated, condition and the increasing spread indicates that the degree of channel incision increases in the downstream direction.

The crest elevation Transcript Dam was not surveyed directly; however, it can be estimated as 714.1, which is approximately 0.25' lower than the water surface elevation surveyed at XS 5000 on August 20, 2013 when the flow was about 35 cfs (combined discharge at the USGS stream gages on the Contoocook River and Nubanusit Brook that afternoon). Using the standard weir equation, a discharge of 35 cfs yields a head of about 0.25' over the dam which has a crest length of approximately 110'.

Figure 6 – View upstream at Transcript Dam from Main Street Bridge (8/20/13)

3.E. Channel Materials

A random sampling of 100 particles collected from the streambed and lower banks within the profiled stream reach indicates that the median size of the channel materials is very coarse gravel with a D_{50} particle size of 36 mm (1.4 inches). A plot of the pebble count particle size distribution is included in Appendix 2.

3.F. Stream Type

The existing stream type of the majority of the Contoocook River in the vicinity of the Route 101 Bridge is B4c – a moderately entrenched, gently meandering, low gradient stream with a moderate width-to-depth ratio and predominantly gravel-sized channel materials. Table 8 summarizes the cross-section geometry of the sections located nearest the bridge (i.e. within the profiled stream reach) and Table 9 summarizes the data used to determine the existing stream type (classification variables in bold).

Table 8 – Measured Channel and Valley Geometry at Cross-Sections along Profiled River Reach

Cross-Section	Bankfull XS Area (sf)	Bankfull Width (ft)	Mean Bankfull Depth (ft)	Width to Depth Ratio	Max. Bankfull Depth (ft)	Width Flood Prone Area (ft)	Entrench Ratio	Incision Ratio
6287	392	91	4.3	21	6.0	149	1.6	1.7
7435	196	56	3.5	16	5.6	100	1.8	2.5
7757	233	60	3.9	15	5.2	168	2.8	1.5
7921	357	67	5.3	13	7.0	129	1.9	1.4
7957	202	68	3.0	23	5.7	103	1.5	2.2
Average Values	*276*	*68*	*4.0*	*18*	*5.9*	*130*	*1.9*	*1.9*

Table 9 – Stream Classification Data

Variable	Value
Bankfull XS Area*	68 ft
Bankfull Width*	276 sf
Mean Bankfull Depth*	4.0 ft
Width-to-Depth Ratio*	**18**
Maximum Bankfull Depth*	5.9 ft
Width of Flood Prone Area*	130 ft
Entrenchment Ratio*	**1.9**
Incision Ratio*	1.9
Sinuosity	**1.08**
Slope	**0.28%**
Channel Materials D_{50}	**36 mm (very coarse gravel)**

* Average value measured at cross-sections 6287, 7435, 7757, 7921, and 7957

B4c is <u>not</u> the reference stream type, that is, the channel form which would exist in the absence of manmade alterations of the channel, floodplain, and/or watershed. Based on the valley and geologic characteristics, the reference stream type is C4 – a slightly entrenched, sinuous, low gradient, gravel bed stream with a moderate to high width-to-depth ratio. It is likely that manmade changes to the channel (e.g. straightening), floodplain (e.g. filling), and watershed (e.g. flow regulation) have all contributed to the departure from the reference stream type.

3.G. <u>Vegetation</u>

The riverbanks and adjacent terraces and low floodplains in the vicinity of the bridge are covered, to varying degrees, by hardwood trees, saplings, shrubs, and herbs including red maple, black cherry, silky dogwood, wild grape, spotted joe-pye weed, and poison ivy. The riparian buffer along the left (west) riverbank near

Figure 7 – View west across the Contoocook River just upstream from the bridge showing floodplain fill and very narrow riparian buffer along the west riverbank (8/15/13)

the bridge is very narrow and non-existent in some locations upstream from the crossing (i.e. along the commercial plaza parking lot). Further from the crossing and plaza the riverbanks and terraces are covered by a mixed hardwood-softwood forest with dominant species including red maple, white pine, ironwood, eastern hemlock, and American beech.

3.H. Channel and Floodplain Alterations

In addition to the aforementioned channel straightening and flow regulation, we found additional evidence of manmade changes which have affected channel form and process. The floodplain on the west side of the river immediately upstream from the bridge has been filled to facilitate commercial development (see Figure 7). Inspection of historic aerial photography also shows that portions of the floodplain along the east side of the channel upstream of the bridge were filled by the highway embankment. In general, floodplain fill concentrates flood flows in the channel thereby increasing velocity, stream power, and stress on the channel boundaries which can contribute to incision and bank erosion when the channel is formed in erodible materials.

Figure 8 – View downstream showing large granite blocks protecting the west bank within the bridge opening (8/19/13)

The riverbanks downstream from the bridge are armored with large, dumped boulder fill which was likely placed when the channel was straightened. Within the bridge opening the banks are armored with large, individually-placed granite blocks (see Figure 8). Upstream from the bridge it appears much of the left bank along the parking lot was once riprapped; however most of that bank protection has failed. A somewhat continuous row of boulders was found on the riverbed about 5 to 10 feet into the river from the toe of the bank, suggesting that the bank eroded behind the boulders which then slid into the channel. These rocks are no longer protecting the bank, which is continuing to erode (see Figure 9).

Figure 9 – View west across the Contoocook River upstream from the bridge showing eroding riverbank adjacent to parking lot (8/16/13)

3.I. Channel Stability

Due to its incised, straightened condition, the channel is not considered stable (i.e. capable of transporting the flows and sediment delivered from its watershed without aggrading or degrading). Greater stream power caused by confinement of flood flows within the channel (loss of floodplain access) and a steeper gradient (channel straightening) increases stress on the channel boundaries and is causing erosion where the channel is not well armored. If left to freely adjust, the river will continue to widen and erode laterally as these adjustments would decrease boundary stress to be more commensurate with boundary resistance. This process would eventually convert the channel back to its reference C4 stream type; however, in light of the infrastructure which would be damaged by this adjustment process, it is unlikely that management of the river back to its reference stream type is feasible.

A more realistic option which would be far more compatible with adjacent land uses in the vicinity of the bridge is to manage the river toward a B4c stream type with a much lower bank height ratio (BHR). The BHR is the ratio of bank height to maximum bankfull depth. A BHR value of 1.0 indicates that the top of the bank is at the bankfull stage and is the most desirable condition for an alluvial bank where vegetation is the primary soil stabilization mechanism. Currently the lowest river banks are several feet higher than the bankfull stage and BHR values are much greater than unity (similar to the incision ratio in most locations). Lowering the BHR values would involve lowering the bank heights and creating narrow floodplain benches along the river as illustrated in Figure 10. This approach would stabilize the eroding banks, increase total discharge capacity, and reduce stream power. Due to the greater capacity, flood levels would likely remain the same or be reduced so that the channel modifications would be in compliance with local and federal floodplain management regulations.

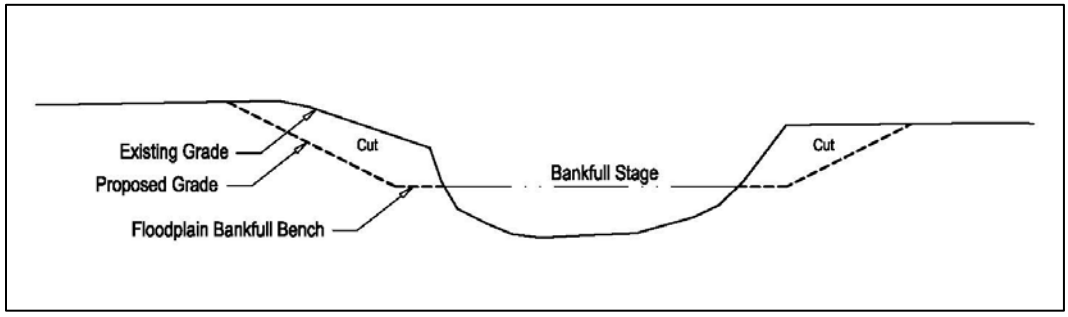


Figure 10 – Schematic of lowering the Bank Height Ratio through the excavation of narrow floodplain benches into high river banks (8/16/13)

3.J. Existing Bridge Compatibility

The existing bridge span is wider than the bankfull channel and provides for a flood prone width of about 100' within the opening. Using the average bankfull width measured at the representative cross-sections (64'), this waterway opening will allow for an entrenchment ratio of about 1.6, which is sufficient for a B4c stream type within the crossing (B-type streams have entrenchment ratios between 1.4 and 2.2). Therefore, the crossing is compatible with a B4c stream, but is not large enough to accommodate the reference C-type stream (a minimum entrenchment ratio of about

140' would be needed); however, due to adjacent land uses, allowing the river to revert to its historic stream type is not likely feasible in the vicinity of the bridge.

As compared to most portions of the studied river reach, the channel at the bridge is quite stable. The span is long enough to have allowed the deposition of a narrow active floodplain surrounding the easterly pier. As a result, the BHR within the waterway opening is 1.0. In addition, the bike path within the bridge opening, although provides additional floodwater conveyance area during rare floods. In general, the cross-section shape with the bridge opening is similar to the proposed grade section illustrated in Figure 10.

We recommend that any modifications to the bridge piers be designed for conditions with the Transcript Dam removed. Removal of the dam could result in additional riverbed degradation and undermining of the piers if their footings are too shallow.

Figure 11 – View downstream (north) at Route 101 Bridge (8/15/13)

Figure 12 – View downstream (north) at bridge showing active floodplain formed along east pier (8/15/13)

4. HEC-RAS Geometry File

The survey data and roadway topographic mapping provided by NHDOT have been used to create a HEC-RAS geometry file for use in modeling existing and proposed hydraulic conditions in the vicinity of the bridge. The file includes all of the cross-sections shown on the attached "Cross-Section Layout Plan" except XS 7435, which is within the bridge contraction reach, and XS 11679, at the gage, which was not surveyed relative to the same vertical datum as the other sections. As previously stated, XS 7757 should be removed from the model if there is flow in the left overbank area.

Two methods were used to estimate the Manning's n roughness coefficient for the channel – Cowan's Method and Jarrett's equation. For Jarrett's equation, the average measured bankfull hydraulic radius and average water surface slope measured upstream from XS 7957 (0.28%) were used. For Cowan's method the base n-value was estimated from Limerinos equation using the average bankfull hydraulic radius and D_{84} from the pebble count. Table 6 summarizes the results of each method. Supporting calculations are included in Appendix 3.

Table 10 – Manning's n Channel Roughness Coefficient Estimates

Method	Manning's n Estimate
Jarrett's Equation	0.034
Back-calculation	0.051
Average Value	*0.043*

The average n-value of 0.043 was input into the geometry file for the channel bed. This is within the range of channel n-values listed in the FIS for the Contoocook River (0.020 – 0.060). Overbank Manning's n roughness coefficients were estimated using the guidance provided in USGS Water-Supply Paper 2339[2] as shown in Table 11. These are within the range of overbank n-values listed in the FIS (0.030 – 0.150).

Table 11 – Manning's n Overbank Roughness Coefficient Estimates

Cover Type	Manning's n Estimate (overbanks)
Forested with herbaceous and shrubby understory vegetation	0.120
Unmaintained herbaceous and shrubby vegetation	0.080
Riprap banks	0.05
Maintained lawns and road right-of-ways	0.040
Pavement	0.030

Channel and overbank reach lengths were determined from the survey information and 2010 orthophotography. To account for flow contraction and expansion which occurs in the immediate vicinity of the bridge, ineffective flow stations at the bridge inlet and outlet sections (XS 7374 and XS 7239, respectively) were estimated using 1:1 contraction and expansion ratios. The left ineffective flow elevation at the inlet section was set at the low point of Route 101, located about 510' west of the west bridge abutment at elevation 723.83.

In closing, we appreciate the opportunity to work with you on this project. I can be reached at (603) 444-2544 or via email (sean@headwatershydrology.com) if you have any questions.

Respectfully submitted,

Sean P. Sweeney, P.E., CWS
Manager
Headwaters Hydrology, PLLC

Attachments: Appendices 1 through 3
Appendix 1 – Hydrology Calculations and Supporting Documentation
Appendix 2 – Fluvial Geomorphic Assessment Data and Exhibits
Appendix 3 – Hydraulics Data

[2] Arcement, George J., Jr. and Schneider, Verne R., Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains, USGS Water-Supply Paper 2339,1989.

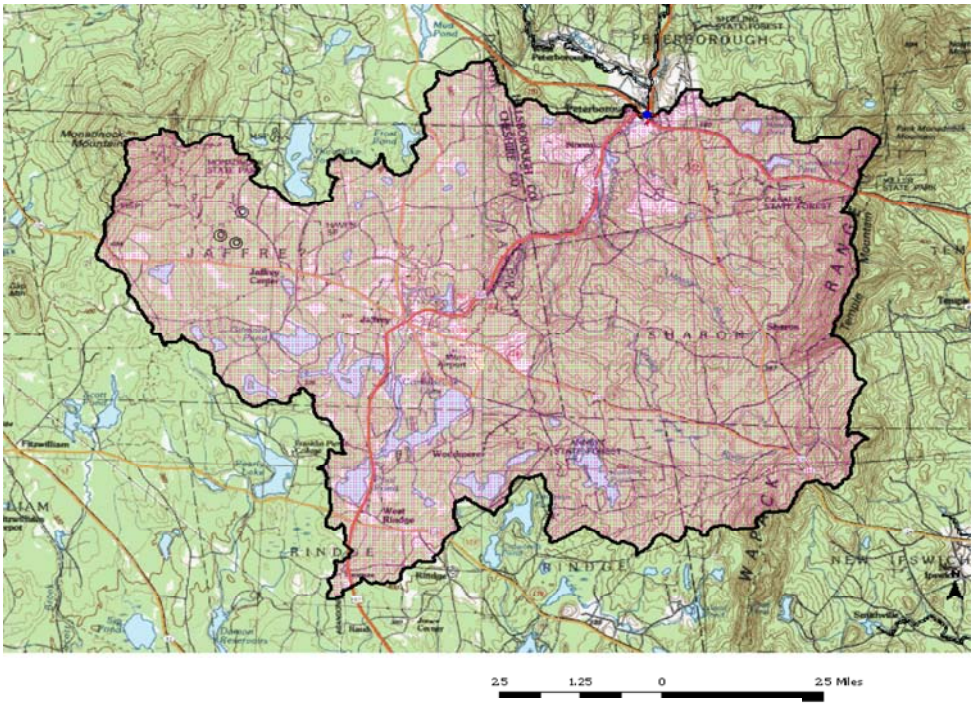
APPENDIX 1

Hydrology Calculations and Supporting Documentation

USGS New Hampshire StreamStats

Watershed Delineation

Contoocook River at NH Route 101



Explanation

- NHDHGage2
- NHDHDam2
- GlobalWatershedPoint
- Slp1085Point
- LongestFlowPath3D
- GlobalWatershed
- Stream Grid
- ExcludePoly

- Gaging Station, Continuous Record
- Low Flow, Partial Record
- Peak Flow, Partial Record
- Peak and Low Flow, Partial Record
- Stage Only
- Low Flow, Partial Record, Stage
- Miscellaneous Record
- Unknown

Click for lessNews Bulletins

- August 8, 2013
- Try our new Mobile-friendly water data site from your mobile device!
- New improved user interface.
- Full News

Peak Streamflow for New Hampshire

Click for less state-specific text

USGS TO DISCONTINUE STREAMGAGES DUE TO SEQUESTRATION: The U.S. Geological Survey (USGS) will discontinue operation of a number of streamgages nationwide due to budget cuts as a result of sequestration. Additional streamgages may be affected if partners reduce their funding to support USGS streamgages. The USGS is working to identify which streamgages will be impacted and when, and will post this information as it becomes available. Streamgages are used nationwide to predict and address drought and flood conditions by monitoring water availability. The USGS and over 850 Federal, State, and local agencies cooperatively fund the USGS streamgaging network, which consists of over 8,000 streamgages. When budget fluctuations occur, the network is impacted.

To view real-time groundwater levels in New Hampshire. click here

USGS 01082000 CONTOOCOOK RIVER AT PETERBOROUGH, NH

Available data for this site: Surface-water: Peak streamflow | GO

Hillsborough County, New Hampshire
Hydrologic Unit Code 01070003
Latitude 42°51'45", Longitude 71°57'35" NAD27
Drainage area 68.1 square miles
Gage datum 731.97 feet above NGVD29

Output formats

Table
Graph
Tab-separated file
peakfq (watstore) format
Reselect output format

Water Year	Date	Gage Height (feet)	Stream-flow (cfs)
1938	Sep. 1938	15.00	
1946	Mar. 09, 1946	4.45	1,090[5]
1947	Apr. 07, 1947	3.72	750[5]
1948	Mar. 22, 1948	5.22	1,700[5]
1949	Jan. 06, 1949	4.30	1,080[5]
1950	Apr. 05, 1950	3.70	740[5]
1951	Nov. 26, 1950	6.35	2,640[5]
1952	Apr. 05, 1952	4.46	1,180[5]
1953	Mar. 16, 1953	5.00	1,540[5]
1954	Sep. 11, 1954	5.32	1,780[5]
1955	Nov. 03, 1954	4.64	1,290[5]
1956	Jan. 10, 1956	5.66	2,050[5]
1957	Jan. 24, 1957		600[5]
1958	Apr. 18, 1958	4.56	1,240[5]
1959	Apr. 03, 1959	4.87[2]	1,450[5]
1960	Sep. 12, 1960	5.93	2,260[5]
1961	Apr. 23, 1961	3.65[2]	715[5]
1962	Apr. 08, 1962	4.51	1,210[5]
1963	Dec. 06, 1962	4.43	1,160[5]
1964	Apr. 15, 1964	3.78[2]	780[5]
1965	Apr. 16, 1965	3.11	459[5]
1966	Mar. 25, 1966	3.70	740[5]
1967	Apr. 03, 1967	4.12	972[5]
1968	Mar. 19, 1968	5.01	1,550[5]
1969	Apr. 10, 1969	4.68	1,320[5]
1970	Nov. 08, 1969	4.70	1,330[5]
1971	Apr. 13, 1971	3.88	830[5]
1972	Apr. 20, 1972	4.44	1,160[5]

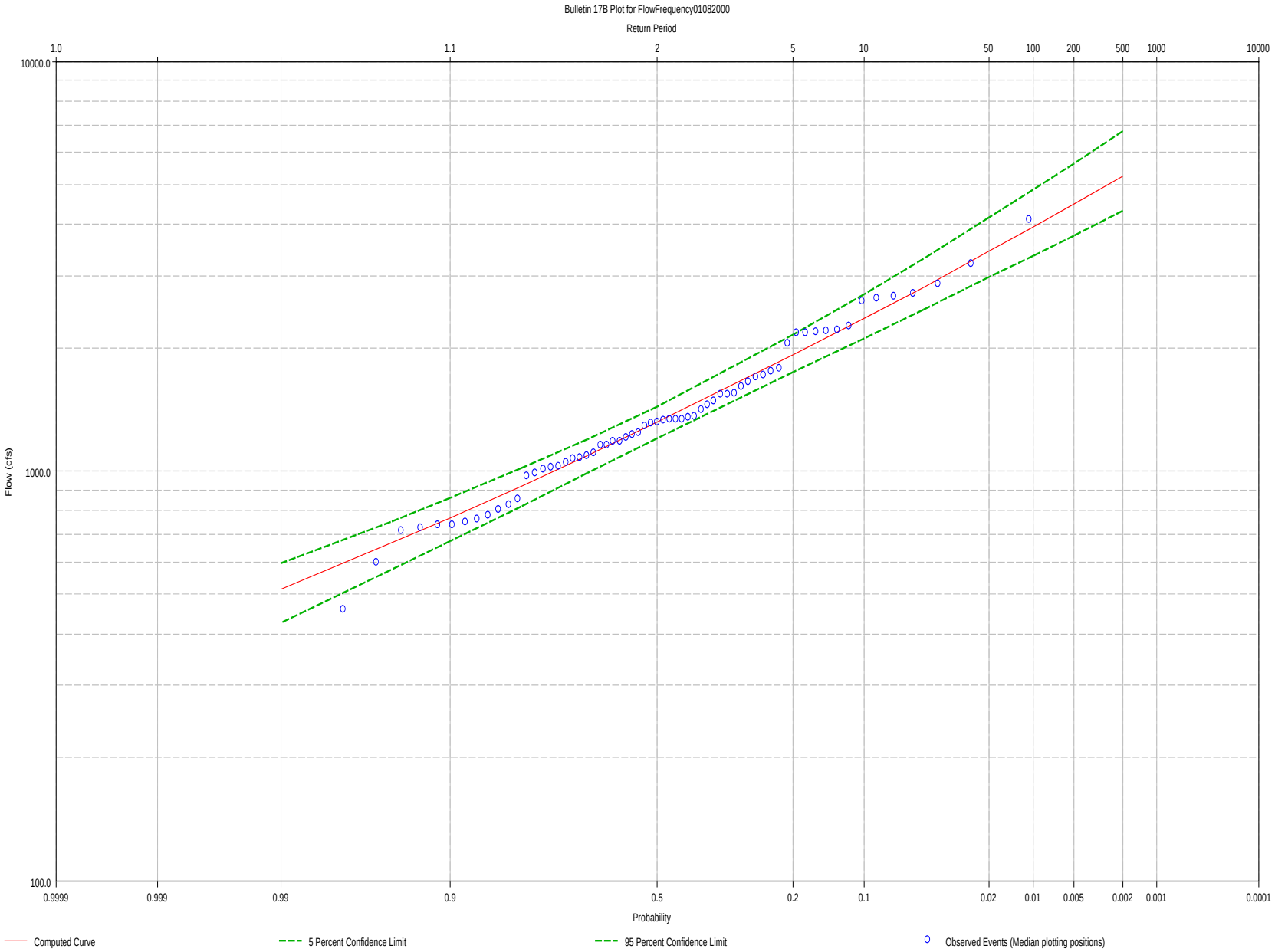
Water Year	Date	Gage Height (feet)	Date	Stream-flow (cfs)	Gage Height (feet)	Stream-flow (cfs)
1973	Mar. 17, 1973				4.67	1,310[5]
1974	Dec. 21, 1973				5.81	2,170[5]
1975	Sep. 27, 1975				4.74	1,360[5]
1976	Apr. 01, 1976				4.20[2]	1,010[5]
1977	Mar. 14, 1977				5.30	1,750[5]
1980	Apr. 10, 1980				5.16	1,650[5,7]
1982	Apr. 05, 1982				3.76	765[5]
1983	Mar. 21, 1983				4.72	1,340[5]
1984	May 31, 1984				5.85	2,200[5]
1985	Mar. 15, 1985				4.40	1,110[5]
1986	Mar. 20, 1986				4.72	1,340[5]
1987	Apr. 06, 1987				6.62	2,860[5]
1988	Apr. 01, 1988				4.22	1,030[5]
1989	Apr. 06, 1989				3.93	857[5]
1990	Oct. 21, 1989				4.55	1,230[5]
1991	Aug. 19, 1991				5.86	2,210[5]
1992	Nov. 26, 1991				4.21	1,020[5]
1993	Apr. 17, 1993				4.35	1,070[5]
1994	Apr. 07, 1994				4.22	989[5]
1995	Dec. 24, 1994				5.01	1,540[5]
1996	Apr. 16, 1996				5.85	2,190[5]
1997	Oct. 21, 1996				5.83	2,170[5]
1998	Jun. 16, 1998				5.11	1,610[5]
1999	Sep. 17, 1999				4.84	1,410[5]
2000	Apr. 23, 2000				3.89	804[5]
2001	Apr. 14, 2001				4.62	1,340[5]
2002	May 14, 2002				3.63	728[5]
2003	Mar. 30, 2003				4.64	1,350[5]
2004	Apr. 02, 2004				6.13	3,210[5]
2005	Apr. 03, 2005				5.67[2]	2,600[5]
2006	Oct. 15, 2005				5.73	2,670[5]
2007	Apr. 16, 2007				7.21	4,110[5]
2008	Apr. 02, 2008				4.13	1,050[5]
2009	Jul. 25, 2009				4.31[2]	1,180[5]
2010	Mar. 15, 2010				6.03	2,710[5]
2011	Mar. 07, 2011				4.98[2]	1,720[5]
2012	Dec. 08, 2011				4.68	1,480[5]

?
Peak Gage-Height Qualification Codes.

- 2 -- Gage height not the maximum for the year

?
Peak Streamflow Qualification Codes.

- 5 -- Discharge affected to unknown degree by Regulation or Diversion
- 7 -- Discharge is an Historic Peak


Bulletin 17B Plot for FlowFrequency01082000
Return Period
1.0
1.1
2
5
10
50
100
200
500
1000
10000
10000.0
1000.0
100.0
Flow (cfs)
0.9999
0.999
0.99
0.9
0.5
0.2
0.1
0.02
0.01
0.005
0.002
0.001
0.0001
Probability
Computed Curve
5 Percent Confidence Limit
95 Percent Confidence Limit
Observed Events (Median plotting positions)

HEC-SSP 2.0 - Bulletin 17B Flow Frequency Analysis

USGS Gage 01082000 - Contoocook River at Peterborough

Frequency Curve for: CONTOOCOOK RIVER-PETERBOROUGH, NH-FLOW-ANNUAL PEAK

Percent Chance Exceedance	Computed Curve Flow in cfs	Confidence Limits Flow in cfs	
		0.05	0.95
0.2	5246.1	6750.1	4325.5
0.5	4482.3	5627.7	3761.9
1.0	3945.1	4857.5	3357.6
2.0	3439.0	4148.6	2969.7
5.0	2811.0	3295.3	2476.3
10.0	2360.1	2704.3	2110.9
20.0	1920.0	2150.0	1741.7
50.0	1314.8	1438.8	1200.8
66.7	1091.8	1195.6	988.4
80.0	919.4	1013.9	820.3
90.0	768.8	858.2	672.5
95.0	666.0	752.5	572.0
99.0	513.9	595.6	425.5

System Statistics

Log Transform: Flow

Statistic	Value
Mean	3.125
Standard Dev	0.190
Station Skew	0.202
Regional Skew	
Weighted Skew	
Adopted Skew	0.202

Number of Events

Event	Number
Historic Events	0
High Outliers	0
Low Outliers	0
Zero Or Missing	1
Systematic Events	65
Historic Period	

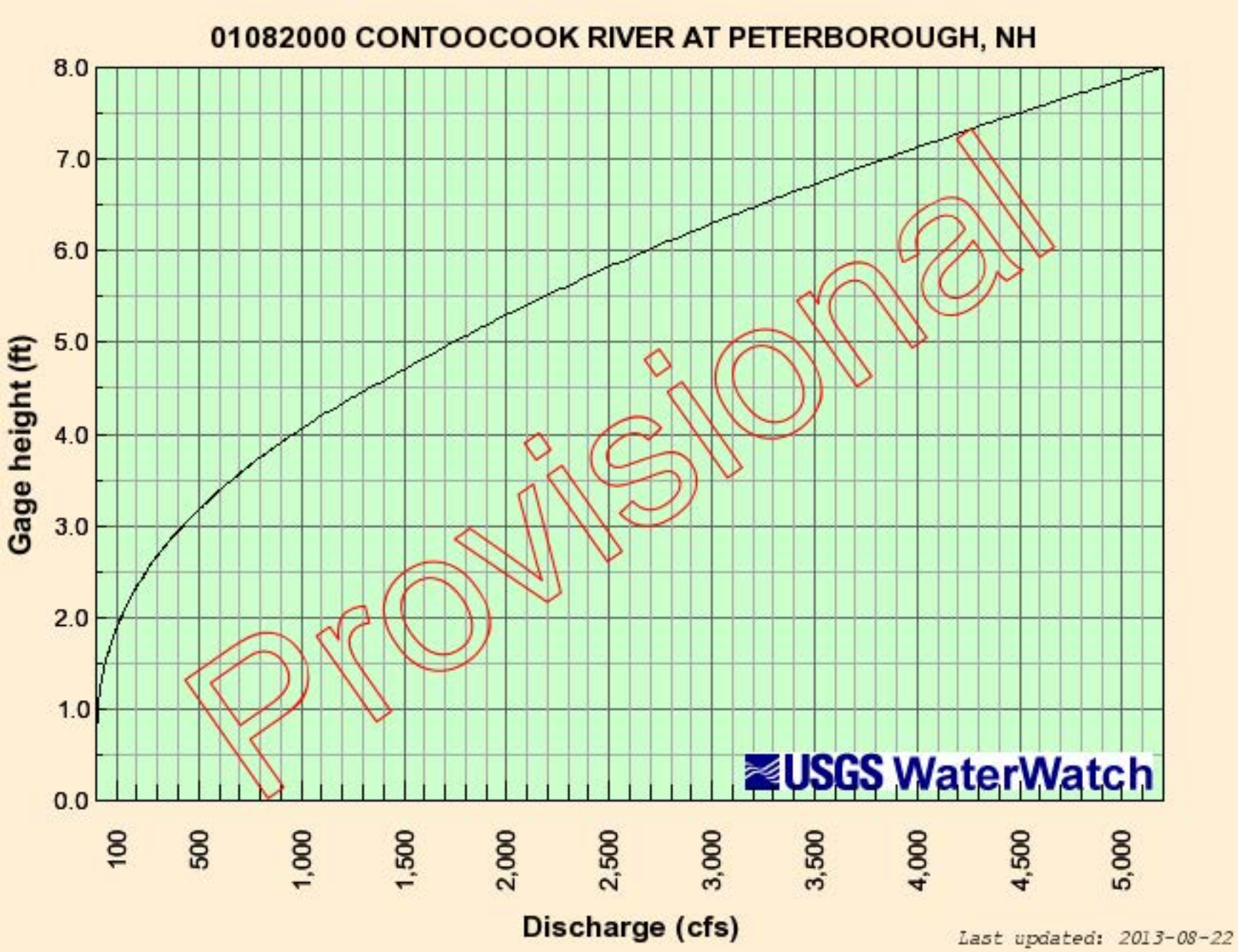

01082000 CONTOOCOOK RIVER AT PETERBOROUGH, NH
Gage height (ft)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
100
500
1,000
1,500
2,000
2,500
3,000
3,500
4,000
4,500
5,000
Discharge (cfs)
Provisional
USGS WaterWatch
Last updated: 2013-08-22

TABLE 5 - SUMMARY OF DISCHARGES - continued

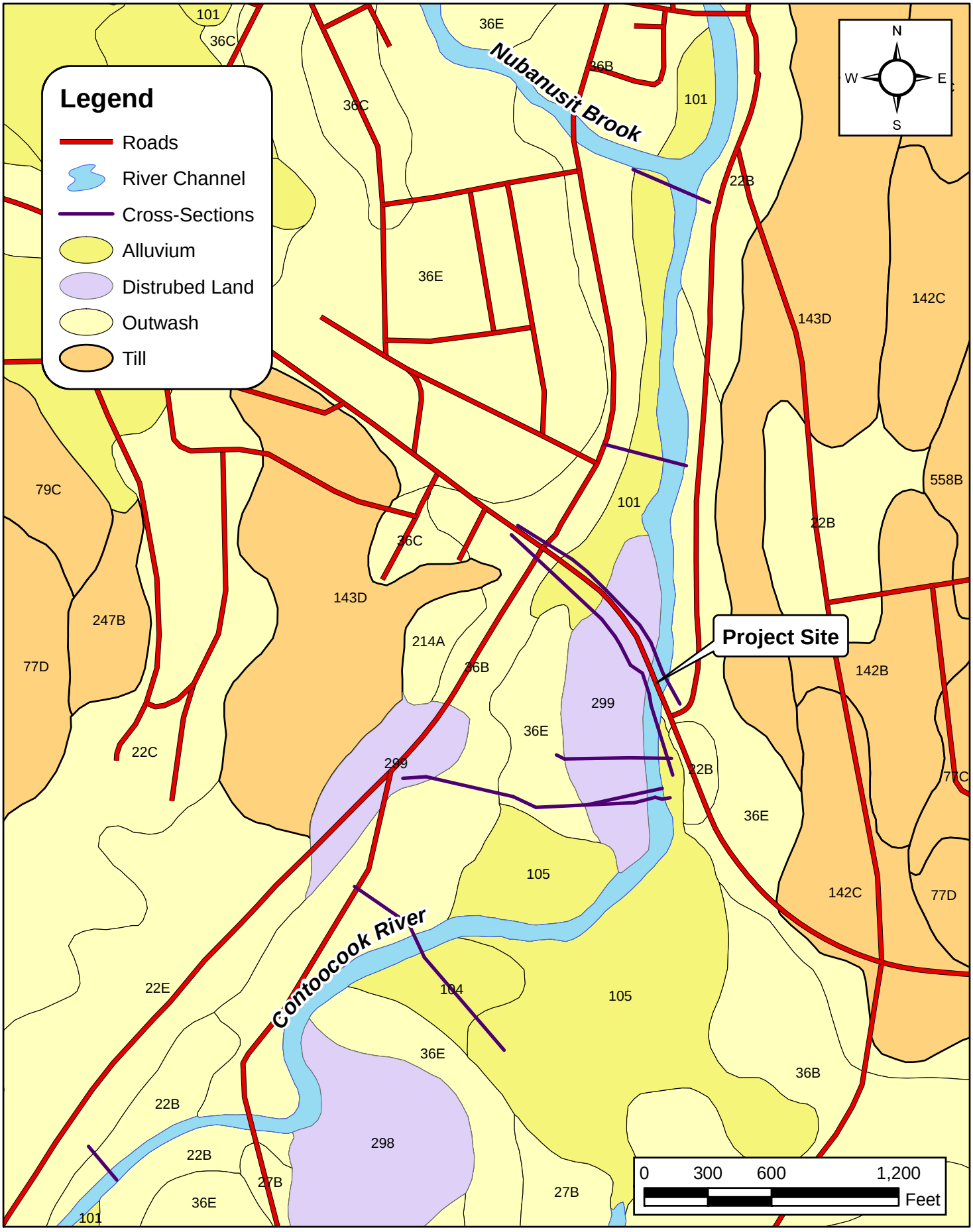
FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
CONTOOCOOK RIVER (continued)					
At Greenfield-Hancock-Peterborough corporate limits	107.0[1]	2,890	5,420	7,500	12,415
At Transcript Dam	79.9[1]	2,660	4,990	7,150	11,430
At USGS Gage	68.1	2,300	4,310	5,700	9,890
At downstream confluence with Gridley River	54.0	1,850	3,470	4,300	7,950
FERGUSON BROOK					
At Link Road	8.6	650	1,200	1,460	2,350
At State Route 137	3.4	290	550	690	1,110
GAMBOL BROOK					
At confluence with Souhegan River	16.2	550	1,180	1,450	2,580
Downstream of Miller Brook	13.3	430	760	950	1,510
GOLDEN BROOK					
At the mouth	17.8	390	860	1,025	1,880
Just downstream of Island Pond Brook	17.4	405	895	1,060	1,940
Just upstream of Island Pond Brook	14.1	345	780	925	1,670
Just downstream of Simpson Mill Brook	12.8	315	720	860	1,550
Pelham-Windham town line	11.6	100	550	705	1,490
GORHAM BROOK					
At confluence with Piscataquog River	6.9	310	590	750	1,220
At confluence with 1st Tributary	5.9	260	490	630	1,040
GREAT BROOK NO. 1					
At mouth	10.0	680	1,250	1,550	2,400

[1]Effective drainage area equals total drainage area minus 44 square miles controlled by Edward MacDowell Dam on Nubanusit Brook

APPENDIX 2

Fluvial Geomorphic Assessment Data and Exhibits

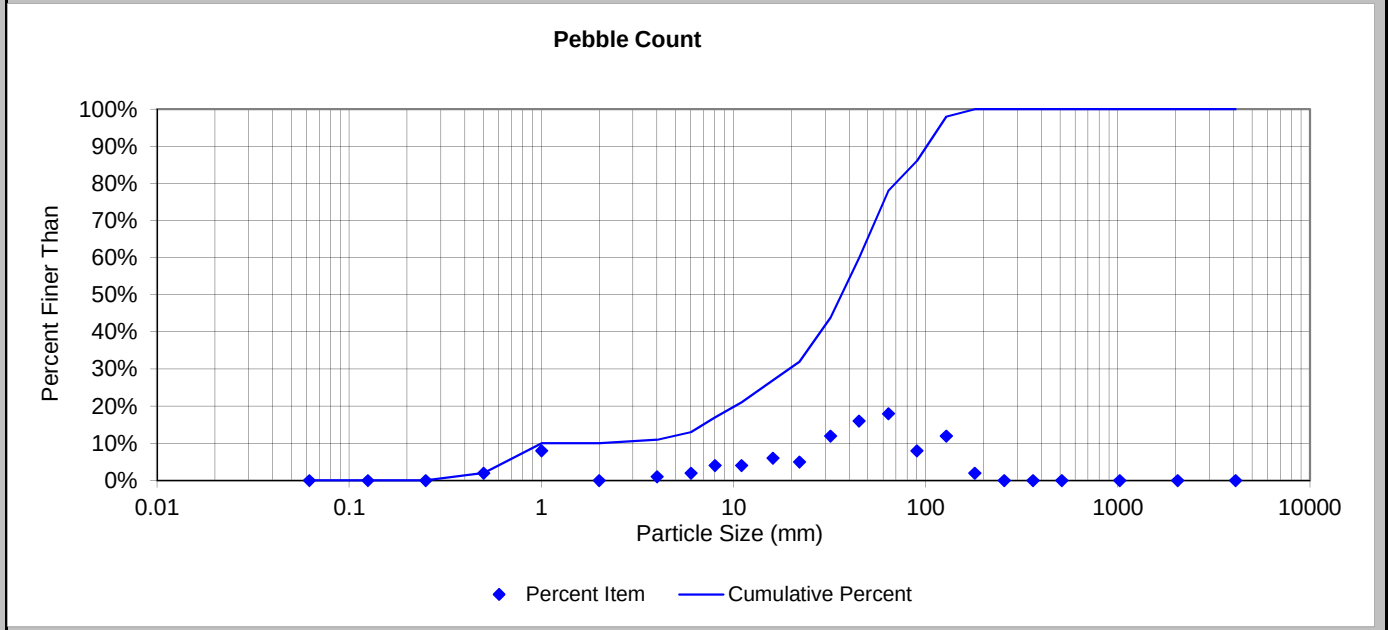
NH Route 101 over the Contoocook River
Peterborough, NH
Soils and Geologic Materials Map



Pebble Count Worksheet

Material	Size Range (mm)		No.
silt/clay	0	0.062	
very fine sand	0.062	0.125	
fine sand	0.125	0.25	
medium sand	0.25	0.5	2
coarse sand	0.5	1	8
very coarse sand	1	2	
very fine gravel	2	4	1
fine gravel	4	6	2
fine gravel	6	8	4
medium gravel	8	11	4
medium gravel	11	16	6
coarse gravel	16	22	5
coarse gravel	22	32	12
very coarse gravel	32	45	16
very coarse gravel	45	64	18
small cobble	64	90	8
medium cobble	90	128	12
large cobble	128	180	2
very large cobble	180	256	
small boulder	256	362	
small boulder	362	512	
medium boulder	512	1024	
large boulder	1024	2048	
very large boulder	2048	4096	
bedrock			
		Total Particles:	100

Stream Name: Contoocook River **Date:** 8/19/2013
Reach: NH Route 101 Bridge **Town:** Peterborogh, NH



	Size percent less than (mm)					Percent by substrate type					
	D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
	7	24	36	83	117	0%	10%	68%	22%	0%	0%

Attachment E

NH Natural Heritage Bureau Response

CONFIDENTIAL – NH Dept. of Environmental Services review

Memo

NH Natural Heritage Bureau
NHB Datacheck Results Letter

To: Joanne Theriault, Hoyle, Tanner & Associates, Inc.
Hoyle, Tanner & Associates, Inc.
150 Dow Street
Manchester, NH 03101

From: Amy Lamb, NH Natural Heritage Bureau
Date: 8/6/2019 (valid for one year from this date)
Re: Review by NH Natural Heritage Bureau
NHB File ID: NHB19-2384 Town: Peterborough Location: NH Route 101 from Grove St. to Pine St.

Description: NHDOT proposes the rehabilitation of US Route 202/NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River as well as approach roadway work and development of traffic control plans. The project underwent a NEPA evaluation in 2014, but work did not commence at that time. NHDOT has determined that the NEPA Categorical Exclusion, supporting documentation and agency coordination needs to be re-evaluated and updated to move forward in order to address regulatory changes since 2014. Previous NHB review: NHB13-3796

cc: Kim Tuttle

As requested, I have searched our database for records of rare species and exemplary natural communities, with the following results.

Comments: The nearest documented Northern Long-Eared Bat record is a breeding season observation located approximately 2.5 miles from the project area. Please contact the NH Fish & Game Department to address wildlife concerns.

Vertebrate species	State[1]	Federal	Notes
Wood Turtle (*Glyptemys insculpta*)	SC	--	Contact the NH Fish & Game Dept (see below).

[1]Codes: "E" = Endangered, "T" = Threatened, "SC" = Special Concern, "--" = an exemplary natural community, or a rare species tracked by NH Natural Heritage that has not yet been added to the official state list. An asterisk (*) indicates that the most recent report for that occurrence was more than 20 years ago.

Contact for all animal reviews: Kim Tuttle, NH F&G, (603) 271-6544.

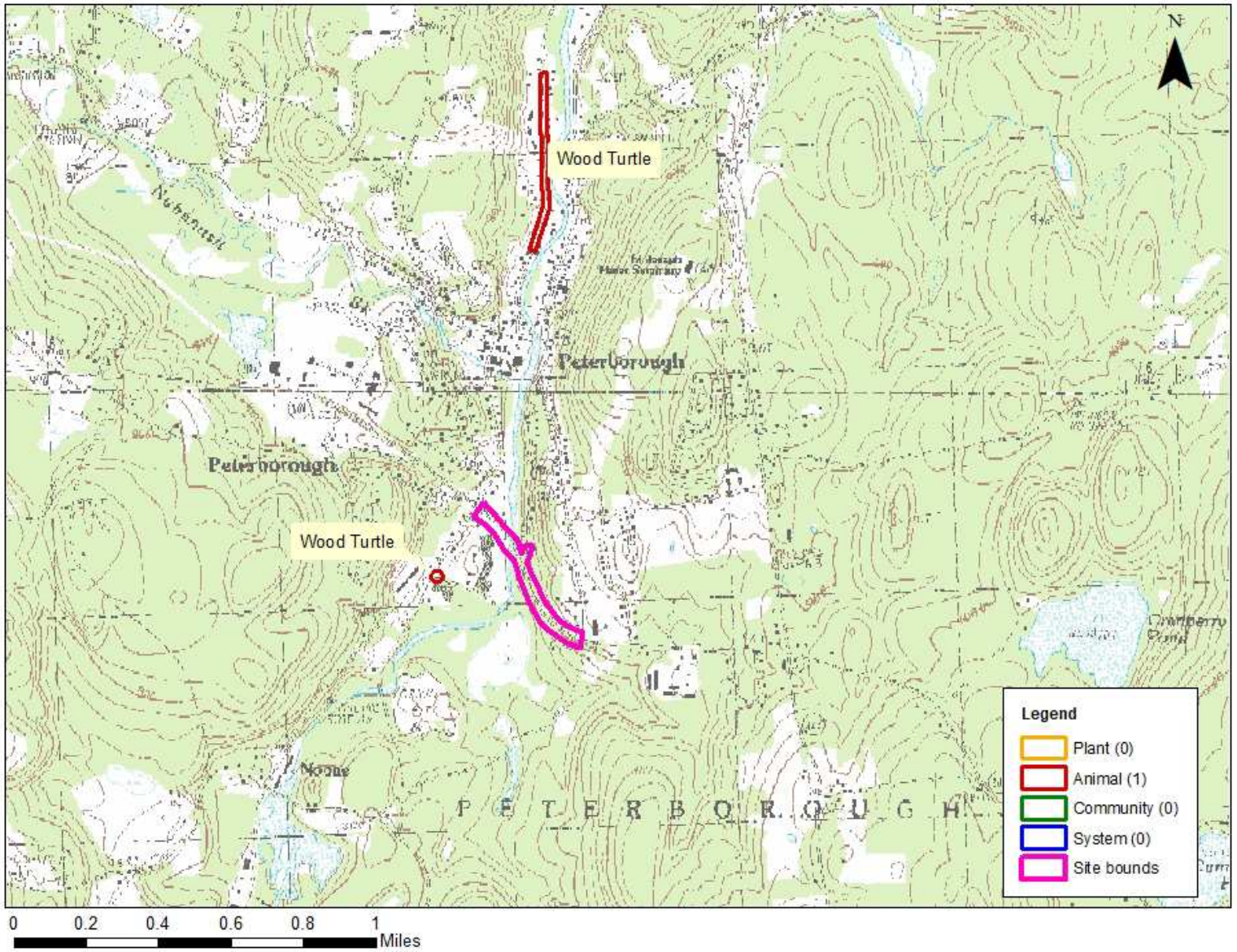
A negative result (no record in our database) does not mean that a sensitive species is not present. Our data can only tell you of known occurrences, based on information gathered by qualified biologists and reported to our office. However, many areas have never been surveyed, or have only been surveyed for certain species. An on-site survey would provide better information on what species and communities are indeed present.

Department of Natural and Cultural Resources
Division of Forests and Lands
(603) 271-2214 fax: 271-6488

DNCR/NHB
172 Pembroke Rd.
Concord, NH 03301

CONFIDENTIAL – NH Dept. of Environmental Services review

NHB19-2384



New Hampshire Natural Heritage Bureau - Animal Record

Wood Turtle (*Glyptemys insculpta*)

Legal Status		Conservation Status	
Federal:	Not listed	Global:	Rare or uncommon
State:	Special Concern	State:	Rare or uncommon

Description at this Location

Conservation Rank: Fair quality, condition and/or landscape context ('C' on a scale of A-D).
Comments on Rank:

Detailed Description: 2012: Area 13072: 1 adult observed.1996: Area 11831: 1 female adult observed in the road.
General Area: 2012: Area 13072: Found on steps of bank.
General Comments: 2012: Area 13072: Observer moved turtle from bank to her house at 29 Taggart Lane, Peterborough.1996: Area 11831: Observed by Jeff Osgood.
Management Comments:

Location

Survey Site Name: Contoocook River
Managed By: Peterborough Water Works Land

County: Hillsborough
Town(s): Peterborough
Size: 6.4 acres Elevation:

Precision: Within (but not necessarily restricted to) the area indicated on the map.

Directions: 2012: Area 13072: TD Bank, 120 Grove Street, Peterborough.1996: Area 11831: About 0.5 miles north of town on Summer Street, next to river.

Dates documented

First reported:	1996-09-04	Last reported:	2012-06-11

The New Hampshire Fish & Game Department has jurisdiction over rare wildlife in New Hampshire. Please contact them at 11 Hazen Drive, Concord, NH 03301 or at (603) 271-2461.

Attachment F

NH F&G Correspondence

Theriault, Joanne E.

From: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Sent: Tuesday, August 20, 2019 1:24 PM
To: Theriault, Joanne E.
Subject: RE: Peterborough Route 101/202 over the Contoocook River: NHB19-2384
Attachments: SEEKING REPORTS OF RARE TURTLES.PDF

Hello Joanne,

As the project design has not changed substantially since the previous review, except for the addition of a Limited Reuse Soil (LRS) stockpiling area, the NHFG Nongame and Endangered Wildlife Program does not expect impacts to wood turtle, a species of concern. Since the stockpile area with its exposed mineral soils may attract several species of turtles to nest there if it is present during the turtle nesting season (late May through the beginning of July), the attached turtle sheet must be distributed to all contractors.

This note should be prominently added to the plans that have to do with the LRS stockpiling area:
IF SPOTTED, WOOD OR BLANDING'S TURTLES ARE FOUND LAYING EGGS IN THE WORK AREA, PLEASE CONTACT MELISSA DOPERALSKI at 603-479-1129 or Josh Megyesy at 978-578-0802 FOR FURTHER INSTRUCTIONS.

Please avoid the use of welded plastic or 'biodegradable plastic' netting or thread (e.g. polypropylene) in erosion control matting. There are numerous documented cases of turtles, snakes and other wildlife being trapped and killed in erosion control matting with synthetic netting and thread. The use of erosion control berm, white Filtrexx Degradable Woven Silt Sock, or several 'wildlife friendly' options such as woven organic material (e.g. coco or jute matting such as North American Green SC150BN or equivalent) are readily available, if needed.

Any Blanding's, spotted, or wood turtle seen at any time should be photographed, if possible, and details reported to the NHFG Nongame and Endangered Species Program in any of the following ways:

Report your sightings of reptiles and amphibians in 3 ways:
1) Email details of observation or completed form to RAARP@wildlife.nh.gov
2) Enter your observation online at http://nhwildlifesightings.unh.edu.
3) Mail your reporting slip http://www.wildlife.state.nh.us/nongame/documents/raarp-report-form.pdf

http://www.wildlife.state.nh.us/nongame/index.html

Check out reptiles and amphibians of NH!
http://www.wildlife.state.nh.us/nongame/reptiles-amphibians.html

Thanks,

Kim Tuttle
Wildlife Biologist
NH Fish and Game
11 Hazen Drive
Concord, NH 03301
603-271-6544

From: Theriault, Joanne E. [mailto:jtheriault@hoyletanner.com]
Sent: Tuesday, August 20, 2019 11:47 AM
To: Tuttle, Kim
Cc: 092592.02 - NHDOT Statewide Env #41768 Peterboro NEPA Re-Eval; Peace, Kimberly R.
Subject: Peterborough Route 101/202 over the Contoocook River: NHB19-2384

Hi Kim,
I'm writing to follow up on an NHB review I received for the replacement of Peterborough Bridge 087/077, NH Route 101/US Route 202 over the Contoocook River. The NHB letter (attached) indicates that there are Wood Turtle records in the vicinity of the proposed project.

This project has been evaluated before and was reviewed previously under the file number NHB13-3796. At that time, you did not expect impacts to the wood turtle as a result of the proposed project (coordination records attached). The project design has not changed since the previous review, except for the addition of a Limited Reuse Soil (LRS) stockpiling area (see attached location maps).

Here is a detailed project description for your information:
The proposed project would include replacement of the US Route 202/NH Route 101 Bridge over the Contoocook River. The deteriorating existing two-pier, two-abutment sub-structure would be replaced with a single pier with four columns spaced at 18'-9" and new, widened abutments. The super-structure will be widened from 43'-6" to 62' in the upstream direction to accommodate the addition of a sidewalk on the upstream side and added space for bicycle traffic, emergency stopping, and vehicle retrieval. A phased construction and traffic control plan would allow vehicles to move through the area without a disruptive detour or expensive temporary bridge configuration. LRS will be stockpiled during construction northwest of the intersection of US Route 202/NH Route 101 and Pine Street.

Would you please review the proposed project area and provide any additional comments you may have pertaining to avoidance of impacts to Wood Turtles?
Thanks so much!
-Joanne

Joanne E. Theriault
Environmental Coordinator

Hoyle, Tanner & Associates, Inc.

Responsive. Consistent. Competent.™

150 Dow Street | Manchester, NH 03101
(603) 669-5555, ext 160 | Fax: (603) 669-4168

From: Lamb, Amy [mailto:Amy.Lamb@dncr.nh.gov]
Sent: Tuesday, August 06, 2019 3:04 PM
To: Theriault, Joanne E. <jtheriault@hoyletanner.com>
Cc: Tuttle, Kim <Kim.Tuttle@wildlife.nh.gov>
Subject: NHB review: NHB19-2384

Attached, please find the review we have completed. If your review memo includes potential impacts to plants or natural communities please contact me for further information. If your project had potential impacts to wildlife, please contact NH Fish and Game at the phone number listed on the review.

Best,
Amy

Amy Lamb
Ecological Information Specialist

NH Natural Heritage Bureau
DNCR - Forests & Lands
172 Pembroke Rd
Concord, NH 03301
603-271-2834

SEEKING REPORTS OF RARE TURTLES

The NH Fish & Game Department is collecting observations of four turtle species:

Blanding's turtle (state endangered)

- Large, dark/black domed shell with lighter speckles
- Distinct yellow throat/chin
- Aquatic but often moves on land

Wood turtle (special concern)

- Sculpted, pyramidal brownish shell
- Orange around neck and limbs
- River/stream turtle spending many months on land

Eastern box turtle (state endangered)

- Small terrestrial turtle with highly domed shell
- Irregular yellow or orange markings over brown/black base

Spotted turtle (state threatened)

- Small, mostly aquatic with black or dark brown with yellow spots.
- Fairly flat shell compared to Blanding's turtle

Report sightings to RAARP@wildlife.nh.gov or 603-271-2461 ***Please report promptly, noting specific location and date – Photographs strongly encouraged***

Attachment G

US F&WS Correspondence

IPaC Results

New Hampshire DOT
Department of Transportation

Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

William Cass, P.E.
Assistant Commissioner

August 28, 2019

Subject: Peterborough, X-A001(007), 15879
FHWA, FRA, FTA Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat
Consultation Code: 05E1NE00-2019-SLI-2395
IPaC Record Locator: 036-18020411

Thomas Chapman, New England Field Office
70 Commercial St, Suite 300
Concord, NH 03301-5087

Dear Mr. Chapman,

Please find enclosed the LAA Consistency Letter: FHWA, FRA, FTA Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bat generated through the Information for Planning and Consultation (IPaC) website regulatory review. NH DOT Project Peterborough 15879 is a project that proposes to replace the US Route 202/NH Route 101 Bridge (Bridge No. 087/0770) over the Contoocook in Peterborough New Hampshire. The proposed project adheres to the criteria and conditions of the FHWA, FRA, FTA USFWS Range-wide Programmatic Consultation, as outlined in the biological assessment (BA) and biological opinion (BO).

The project will include tree clearing during the active season in the amount of (.30 Acre). Tree clearing is anticipated to occur in summer of 2020 after July 31st.

The Official Species List for the project area only included the Northern Long-eared Bat.

The NH DOT has coordinated with New Hampshire Natural Heritage Bureau and the New Hampshire Fish and Game Nongame and Endangered Wildlife Program to ascertain that there are no known NLEB maternity roost trees or hibernacula in the project area or in the vicinity of the project. All project tree clearing will be within 300 feet of the road surface.

The IPaC FHWA, FRA, FTA Programmatic Consultation for Transportation Projects affecting NLEB or Indiana Bat Determination Key was utilized to review the project area(s) and activities. The NH DOT has determined that the project may affect, is likely to adversely affect (LAA) the NLEB, as the project includes tree clearing that will be conducted during the NLEB active season in Peterborough. The DOT will employ appropriate Avoidance and Mitigation Measures as indicated in the LAA Consistency Letter for the project.

Please feel free to contact me with any questions or concerns about the project.

Sincerely,

Matt Urban
Chief, Operations Management Section
603-271-7969
Matt.Urban@dot.nh.gov

Enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

IPaC Record Locator: 036-18020411 August 26, 2019

Subject: Consistency letter for the 'Reconstruction of US Route 202 and NH Route 101 Bridge, Peterborough, NH' project (TAILS 05E1NE00-2019-R-2395) under the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

To whom it may concern:

The U.S. Fish and Wildlife Service (Service) has received your request dated to verify that the **Reconstruction of US Route 202 and NH Route 101 Bridge, Peterborough, NH** (Proposed Action) may rely on the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat (PBO) to satisfy requirements under Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 *et seq.*).

Based on the information you provided (Project Description shown below), you have determined that the Proposed Action is within the scope and adheres to the criteria of the PBO, including the adoption of applicable avoidance and minimization measures, and may affect, and is likely to adversely affect the endangered Indiana bat (*Myotis sodalis*) and/or the threatened Northern long-eared bat (*Myotis septentrionalis*). Consultation with the Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) is required.

This "may affect - likely to adversely affect" determination becomes effective when the lead Federal action agency or designated non-federal representative uses it to ask the Service to rely on the PBO to satisfy the agency's consultation requirements for this project. Please provide this consistency letter to the lead Federal action agency or its designated non-federal representative with a request for its review, and as the agency deems appropriate, transmittal to this Service Office for verification that the project is consistent with the PBO.

This Service Office will respond by letter to the requesting Federal action agency or designated non-federal representative within 30 calendar days to:

- verify that the Proposed Action is consistent with the scope of actions covered under the PBO;
- verify that all applicable avoidance, minimization, and compensation measures are included in the action proposal;
- identify any action-specific monitoring and reporting requirements, consistent with the monitoring and reporting requirements of the PBO, and
- identify anticipated incidental take.

ESA Section 7 compliance for this Proposed Action is not complete until the Federal action agency or its designated non-federal representative receives a verification letter from the Service.

For Proposed Actions that include bridge/structure removal, replacement, and/or maintenance activities: If your initial bridge/structure assessments failed to detect Indiana bats, but you later detect bats during construction, please submit the Post Assessment Discovery of Bats at Bridge/Structure Form (User Guide Appendix E) to this Service Office. In these instances, potential incidental take of Indiana bats may be exempted provided that the take is reported to the Service.

If the Proposed Action may affect any other federally-listed or proposed species and/or designated critical habitat, additional consultation between the lead Federal action agency and this Service Office is required. If the proposed action has the potential to take bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act may also be required. In either of these circumstances, please advise the lead Federal action agency for the Proposed Action accordingly.

Project Description

The following project name and description was collected in IPaC as part of the endangered species review process.

Name

Reconstruction of US Route 202 and NH Route 101 Bridge, Peterborough, NH

Description

NHDOT proposes the reconstruction of US Route 202/NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River as well as approach roadway work and development of traffic control plans. The project underwent a NEPA evaluation in 2014 but did not commence at that time. NHDOT has determined that the NEPA Categorical Exclusion, supporting documentation and agency coordination needs to be re-evaluated and updated to move forward in order to address regulatory changes since 2014.
The existing two-pier, two-abutment substructure will be replaced with a single pier with four columns spaced at 18'-9" and new, widened abutments, and the super-structure will be widened from 43'-6" to 62' in the upstream direction to accommodate the addition of a sidewalk on the north side and added space for bicycle traffic, emergency stopping, and vehicle retrieval. Construction is proposed during low-flow conditions in the summer of 2020.

Determination Key Result

Based on your answers provided, this project is likely to adversely affect the endangered Indiana bat and/or the threatened Northern long-eared bat. Therefore, consultation with the U.S. Fish and Wildlife Service pursuant to Section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended 16 U.S.C. 1531 *et seq.*) is required. However, also based on your answers provided, this project may rely on the conclusion and Incidental Take Statement provided in the revised February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects within the Range of the Indiana Bat and Northern Long-eared Bat.

Qualification Interview

1. Is the project within the range of the Indiana bat[1]?

   [1] See Indiana bat species profile

   Automatically answered
   No

2. Is the project within the range of the Northern long-eared bat[1]?

   [1] See Northern long-eared bat species profile

   Automatically answered
   Yes

3. Which Federal Agency is the lead for the action?
   A) Federal Highway Administration (FHWA)

4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales)

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   No

5. Does the project include *any* activities that are **greater than** 300 feet from existing road/ rail surfaces[1]?

   [1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

   No

6. Does the project include *any* activities **within** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]?

   [1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

   No

7. Is the project located **within** a karst area?

   No

8. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   [2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the national consultation FAQs.

   Yes

9. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat?

   [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

   Yes

10. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail?

    No

11. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] **within** the suitable habitat located within your project action area?

    [1] See the Service's summer survey guidance for our current definitions of suitable habitat.

    [2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

    [3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

    [4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

    No

12. Does the project include activities **within documented NLEB habitat**[1][2]?

    [1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

    [2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

    No

13. Will the removal or trimming of habitat or trees occur **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors?

    Yes

14. What time of year will the removal or trimming of habitat or trees **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors occur?

    A) During the active season

15. Will *any* tree trimming or removal occur **within** 100 feet of existing road/rail surfaces?
    Yes

16. Will **more than** 10 trees be removed **between** 0-100 feet of the road/rail surface *during* the active season[1]?

    [1] Areas containing more than 10 trees will be assessed by the local Service Field Office on a case-by-case basis with the project proponent.

    Yes

17. Will the tree removal alter *any* **documented** Indiana bat or NLEB roosts and/or alter any surrounding summer habitat **within** 0.25 mile of a documented roost?
    No

18. Will *any* tree trimming or removal occur **between** 100-300 feet of existing road/rail surfaces?
    No

19. Are *all* trees that are being removed clearly demarcated?
    Yes

20. Will the removal of habitat or the removal/trimming of trees involve the use of **temporary** lighting?
    Yes

21. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing **permanent** lighting?
    Yes

22. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation?
    No

23. Does the project include slash pile burning?
    No

24. Does the project include *any* bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)?
    Yes

25. Is there *any* suitable habitat[1] for Indiana bat or NLEB **within** 1,000 feet of the bridge? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat)

    [1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

    Yes

26. Has a bridge assessment[1] been conducted **within** the last 24 months[2] to determine if the bridge is being used by bats?

    [1] See User Guide Appendix D for bridge/structure assessment guidance

    [2] Assessments must be completed no more than 2 years prior to conducting any work below the deck surface on all bridges that meet the physical characteristics described in the Programmatic Consultation, regardless of whether assessments have been conducted in the past. Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that bridge/structure in subsequent years.

    Yes

    SUBMITTED DOCUMENTS

    - *Bridge 087-077 Appendix D_Bridge Evaluation Form.pdf https://ecos.fws.gov/ipac/project/46EZVVKQCJHMFIENX4HKDU5Z3M/projectDocuments/17946604*

27. Did the bridge assessment detect *any* signs of Indiana bats and/or NLEBs roosting in/under the bridge (bats, guano, etc.)[1]?

    [1] If bridge assessment detects signs of *any* species of bats, coordination with the local FWS office is needed to identify potential threatened or endangered bat species. Additional studies may be undertaken to try to identify which bat species may be utilizing the bridge prior to allowing *any* work to proceed.

    Note: There is a small chance bridge assessments for bat occupancy do not detect bats. Should a small number of bats be observed roosting on a bridge just prior to or during construction, such that take is likely to occur or does occur in the form of harassment, injury or death, the PBO requires the action agency to report the take. Report all unanticipated take within 2 working days of the incident to the USFWS. Construction activities may continue without delay provided the take is reported to the USFWS and is limited to 5 bats per project.

    No

28. Will the bridge removal, replacement, and/or maintenance activities include installing new or replacing existing **permanent** lighting?

    Yes

29. Does the project include the removal, replacement, and/or maintenance of *any* structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.)

    No

30. Will the project involve the use of *any* **temporary** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees), or bridge/structure removal, replacement or maintenance activities?

    Yes

31. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **temporary** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be used?

    Yes

32. Will the project install *any* new or replace any existing **permanent** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities?

    No

33. Does the project include percussives or other activities (**not including tree removal/ trimming or bridge/structure work**) that will increase noise levels above existing traffic/ background levels?

    No

34. Are *all* project activities that are **not associated with** habitat removal, tree removal/ trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives, limited to actions that DO NOT cause any additional stressors to the bat species?

    Examples: lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.

    Yes

35. Will the project raise the road profile **above the tree canopy**?

    No

36. Are the project activities that are not associated with habitat removal, tree removal/ trimming, bridge and/or structure activities, temporary or permanent lighting, or use of percussives consistent with a No Effect determination in this key?

    Automatically answered

    Yes, other project activities are limited to actions that DO NOT cause any additional stressors to the bat species as described in the BA/BO

37. Is the habitat removal portion of this project consistent with a Likely to Adversely Affect determination in this key?

    Automatically answered

    Yes, because tree removal that occurs during the active season occurs within 100 feet from the existing road/rail surface, is not in documented NLEB roosting/foraging habitat or travel corridors, and a visual survey has not been conducted

38. Is the bridge removal, replacement, or maintenance activities portion of this project consistent with a No Effect determination in this key?

    Automatically answered

    Yes, because the bridge has been assessed using the criteria documented in the BA and no signs of bats were detected

39. **General AMM 1**

    Will the project ensure *all* operators, employees, and contractors working in areas of known or presumed bat habitat are aware of *all* FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable Avoidance and Minimization Measures?

    Yes

40. **Tree Removal AMM 1**

    Can *all* phases/aspects of the project (e.g., temporary work areas, alignments) be modified, to the extent practicable, to avoid tree removal[1] in excess of what is required to implement the project safely?

    Note: Tree Removal AMM 1 is a minimization measure, the full implementation of which may not always be practicable. Projects may still be NLAA as long as Tree Removal AMMs 2, 3, and 4 are implemented and LAA as long as Tree Removal AMMs 3, 5, 6, and 7 are implemented.

    [1] The word "trees" as used in the AMMs refers to trees that are suitable habitat for each species within their range. See the USFWS' current summer survey guidance for our latest definitions of suitable habitat.

    Yes

41. **Tree Removal AMM 3**
Can tree removal be limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits)?

Yes

42. **Lighting AMM 1**
Will *all* **temporary** lighting used during the removal of suitable habitat and/or the removal/trimming of trees within suitable habitat be directed away from suitable habitat during the active season?

Yes

43. **Lighting AMM 2**
Does the lead agency use the BUG (Backlight, Uplight, and Glare) system developed by the Illuminating Engineering Society[1][2] to rate the amount of light emitted in unwanted directions?

[1] Refer to Fundamentals of Lighting - BUG Ratings

[2] Refer to The BUG System—A New Way To Control Stray Light

No

44. **Lighting AMM 2**
Will *all* **permanent** lighting used during removal of suitable habitat and/or the removal/trimming of trees within suitable habitat use downward-facing, full cut-off[1] lens lights (with same intensity or less for replacement lighting)?

[1] Refer to Luminaire classification for controlling stray light

Yes

45. **Lighting AMM 2**
Will *all* **permanent** lighting used during removal of suitable habitat and/or the removal/trimming of trees within suitable habitat be directed away from *all* areas with suitable habitat?

Yes

46. **Lighting AMM 1**
    Will *all* **temporary** lighting (besides that indicated for tree clearing or bridge/structure removal, replacement or maintenance activities) be directed away from suitable habitat during the active season?

    Yes

47. For Indiana bat, if applicable, compensatory mitigation measures are required to offset adverse effects on the species (see Section 2.10 of the BA). Please select the mechanism in which compensatory mitigation will be implemented:
    6. Not Applicable

Project Questionnaire

1. Have you made a No Effect determination for *all* other species indicated on the FWS IPaC generated species list?
   N/A

2. Have you made a May Affect determination for *any* other species on the FWS IPaC generated species list?
   N/A

3. How many acres[1] of trees are proposed for removal between 0-100 feet of the existing road/rail surface?

   [1] If described as number of trees, multiply by 0.09 to convert to acreage and enter that number.

   0.30

4. **Please verify:**
   All tree removal will occur greater than 0.5 mile from any hibernaculum.

   Yes, I verify that all tree removal will occur greater than 0.5 miles from any hibernaculum.

5. Is the project location 0-100 feet from the edge of existing road/rail surface?
   Yes

6. Is the project location 100-300 feet from the edge of existing road/rail surface?
   No

7. **Please verify:**

No documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted between June 1 and July 31.

Yes, I verify that no documented NLEB roosts or surrounding summer habitat within 150 feet of documented roosts will be impacted during this period.

8. Please describe the proposed bridge work:
   Replacement of the existing bridge and abutments with a single-pier and new, widened abutments and approach roadway work.

9. Please state the timing of all proposed bridge work:
   Construction is proposed for low flow conditions i the summer of 2020, tree removal will occur after July 31.

10. Please enter the date of the bridge assessment:
    8/15/19

11. You have indicated that the following Avoidance and Minimization Measures (AMMs) will be implemented as part of the proposed project:
    - *General AMM 1*
    - *Lighting AMM 1*
    - *Lighting AMM 2*
    - *Tree Removal AMM 1*
    - *Tree Removal AMM 3*

Avoidance And Minimization Measures (AMMs)

This determination key result includes the committment to implement the following Avoidance and Minimization Measures (AMMs):

GENERAL AMM 1

Ensure all operators, employees, and contractors working in areas of known or presumed bat habitat are aware of all FHWA/FRA/FTA (Transportation Agencies) environmental commitments, including all applicable AMMs.

LIGHTING AMM 1

Direct temporary lighting away from suitable habitat during the active season.

LIGHTING AMM 2

When installing new or replacing existing permanent lights, use downward-facing, full cut-off lens lights (with same intensity or less for replacement lighting); or for those transportation agencies using the BUG system developed by the Illuminating Engineering Society, be as close to 0 for all three ratings with a priority of "uplight" of 0 and "backlight" as low as practicable.

TREE REMOVAL AMM 1

Modify all phases/aspects of the project (e.g., temporary work areas, alignments) to avoid tree removal.

TREE REMOVAL AMM 3

Ensure tree removal is limited to that specified in project plans and ensure that contractors understand clearing limits and how they are marked in the field (e.g., install bright colored flagging/fencing prior to any tree clearing to ensure contractors stay within clearing limits).

Determination Key Description: FHWA, FRA, FTA Programmatic Consultation For Transportation Projects Affecting NLEB Or Indiana Bat

This key was last updated in IPaC on March 16, 2018. Keys are subject to periodic revision.

This decision key is intended for projects/activities funded or authorized by the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), and/or Federal Transit Administration (FTA), which require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 of the Endangered Species Act (ESA) for the endangered **Indiana bat** (*Myotis sodalis*) and the threatened **Northern long-eared bat** (NLEB) (*Myotis septentrionalis*).

This decision key should only be used to verify project applicability with the Service's February 5, 2018, FHWA, FRA, FTA Programmatic Biological Opinion for Transportation Projects. The programmatic biological opinion covers limited transportation activities that may affect either bat species, and addresses situations that are both likely and not likely to adversely affect either bat species. This decision key will assist in identifying the effect of a specific project/activity and applicability of the programmatic consultation. The programmatic biological opinion is not intended to cover all types of transportation actions. Activities outside the scope of the programmatic biological opinion, or that may affect ESA-listed species other than the Indiana bat or NLEB, or any designated critical habitat, may require additional ESA Section 7 consultation.

Bridge/Structure Assessment Form

This form will be completed and submitted to the District Environmental Manager by the Contractor prior to conducting any work below the deck surface either from the underside, from activities above that bore down to the underside, or that could impact expansion joints, from deck removal on bridges, or from structure demolish. Each bridge/structure to be worked on must have a current bridge inspection. Any bridge/structure suspected of providing habitat for any species of bat will be removed from work schedules until such time that the DOT has obtained clearance from the US Fish and Wildlife Service, if required. Additional studies may be undertaken by the DOT to determine what species may be utilizing structures prior to allowing any work to proceed.

DOT Project #	Water Body	Date/Time of Inspection
15879	Contoocook River	8/15/19 - 11:50am

Route:	County:	Federal Structure ID:	Bat Indicators Check all that apply. Presence of one or more indicators is sufficient evidence that bats may be using the structure.				
NH101, US202	Hillsborough	087/077	Visual	Sound	Droppings	Staining	**Notes: (e.g., number & species of bats, if known. Include the results of thermal, emergent, or presence/absence summer survey)**
							Staining on Pier 2 post-field determination
							Caused by rust/corrosion drainage pipe

Areas Inspected (Check all that apply)

Bridges		Culverts/Other Structures		Summary Info (circle all that apply)			
All vertical crevices sealed at the top and 0.5-1.25" wide & ≥4" deep	✓	**Crevices, rough surfaces or imperfections in concrete**		**Human disturbance or traffic under bridge/in culvert or at the structure**	High	Low	None

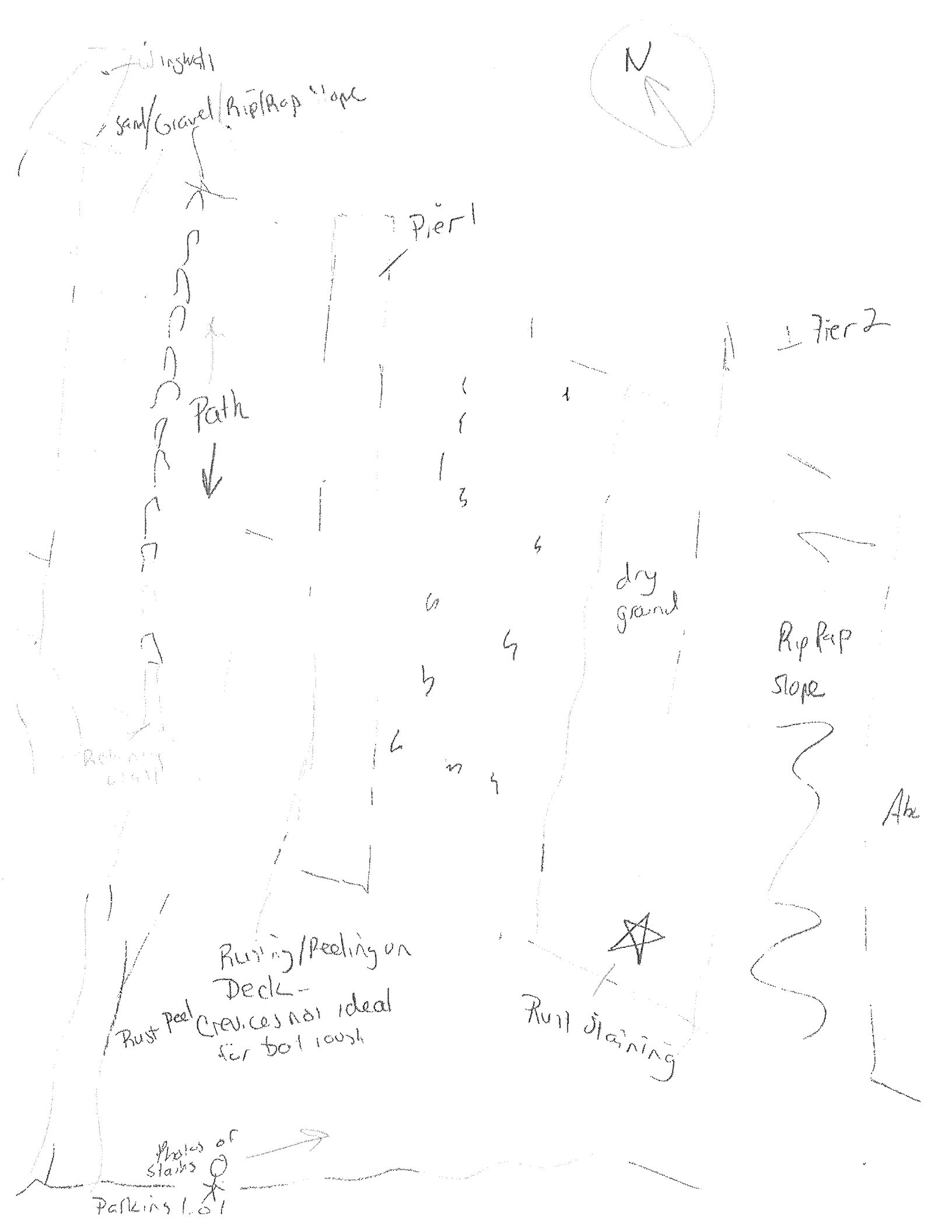
All crevices >12" deep & not sealed	✓	**Spaces between walls, ceiling joists**		**Possible corridors for netting**	None/poor	Marginal	Excellent
All guardrails	✓			**Evidence of bats using bird nests, if present?**	Yes	No	
All expansion joints	✓						
Spaces between concrete end walls and the bridge deck	✓						
Vertical surfaces on concrete I-beams	✓						

Assessment Conducted By: Joanne Theriault **Signature(s):** _____

District Environmental Use Only: Date Received by District Environmental Manager: _____

DOT Bat Assessment Form Instructions

1. Assessments must be completed a minimum of 1 year prior to conducting any work below the deck surface on all bridges that meet the physical characteristics described in the Programmatic Consultation, regardless of whether assessments have been conducted in the past. **Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that structure in subsequent years.**
2. Any bridge/structure suspected of providing habitat for any species of bat will be removed from work schedules until such time that the DOT has obtained clearance from the USFWS, if required. Additional studies may be undertaken by the DOT to determine what species may be utilizing each structure identified as supporting bats prior to allowing any work to proceed.
3. Estimates of numbers of bats observed should be place in the Notes column.
4. Any questions should be directed to the District Environmental Manager.


N
Sand/Gravel/RipRap Slope
Pier 1
Pier 2
Path
dry ground
RipRap Slope
Rusting/Peeling on Deck - Rust Peel Crevices not ideal for boat work
Rust staining
Photos of stairs
Parking Lot

Peterborough, #15879

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104
http://www.fws.gov/newengland

In Reply Refer To:
Consultation Code: 05E1NE00-2019-SLI-2395
Event Code: 05E1NE00-2019-E-06185
Project Name: Rehabilitation of US Route 202 and NH Route 101 Bridge, Peterborough, NH

July 26, 2019

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

Project Summary

Consultation Code: 05E1NE00-2019-SLI-2395

Event Code: 05E1NE00-2019-E-06185

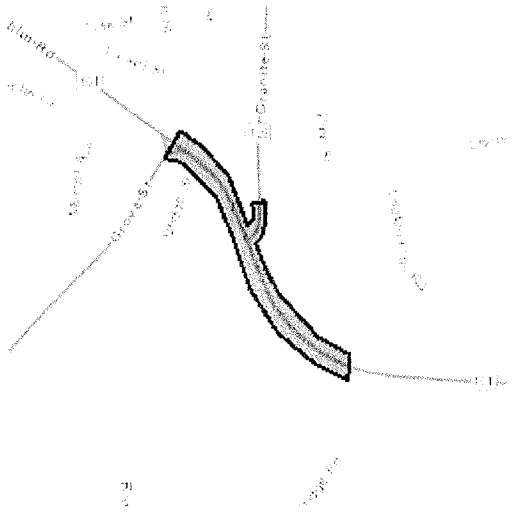
Project Name: Rehabilitation of US Route 202 and NH Route 101 Bridge, Peterborough, NH

Project Type: BRIDGE CONSTRUCTION / MAINTENANCE

Project Description: The Town of Peterborough proposes the rehabilitation of US Route 202/ NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River as well as approach roadway work and development of traffic control plans. The project underwent a NEPA evaluation in 2014 but did not commence at that time. NHDOT has determined that the NEPA Categorical Exclusion, supporting documentation and agency coordination needs to be re-evaluated and updated to move forward in order to address regulatory changes since 2014.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/42.8679124160865N71.94903815089287W



Counties: Hillsborough, NH

Endangered Species Act Species

There is a total of 1 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION

Attachment H

NHDHR Review /

Cultural Resources Effect Memo

Cultural Resources Effect Memo
(Municipally Managed Projects)

Project Name: Peterborough

Date: April 2, 2012

State No.: 15879

Federal No. (as applicable): X-A001(007)

Pursuant to the *Request for Project Review* on March 3, 2012 , and for the purpose of compliance with the regulations of National Historic Preservation Act and the Advisory Council on Historic Preservation's *procedures for the Protection of Historic Properties* (36 CFR 800), the NH Division of Historical Resources and, when applicable, the NH Division of the Federal Highway Administration or the US Army Corps of Engineers have coordinated the identification and evaluation of cultural resources relative to (project description):

The project involves the rehabilitation of the US Route 202/NH Route 101 Bridge (Bridge No. 087/077) over the Contoocook River in Peterborough, NH, as well as minor approach roadway work and development of a traffic control plan. It is anticipated that the existing abutments and pier will be rehabilitated and widened as necessary to accommodate a widened superstructure. The extent of superstructure widening may be dictated by traffic control plan needs or permanent width requirements, such as wider shoulders.

Based on a review of the project, as presented on this date, it has been determined that:

☒ **No Historic or Archaeological Properties will be Affected**

☐ **There will be No Adverse Effect on Historic or Archaeological Properties**
Describe any outstanding commitments:_____

_____

_____

☐ **There will be an Adverse Effect on Historic or Archaeological Properties or Resources**
describe the effect, measures to minimize harm and proposed mitigation_____

_____

_____(attach pages as Necessary).

In accordance with the Advisory Council's regulations, we will continue to consult, as appropriate, as this project proceeds.

The NH State Historic Preservation Officer concurs with these findings: _____ DVHR
NH Division of Historical Resources
4-5-12

There Will Be: No 4(f) ☒; Programmatic 4(f) ☐; Full 4 (f) ☐; or

☐ **A finding of de minimis 4(f) impact as stated:** In addition, with NHDHR concurrence of no adverse effect for the above undertaking, and in accordance with Section 6009(a) of the 2005 SAFETEA-LU transportation program reauthorization, FHWA intends to, and by signature below, does make a finding of *de minimis* impact. NHDHR's signature below represents concurrence with both the no adverse effect determination and the de minimis findings. Parties to the Section 106 process have been consulted and their concerns have been taken into account. Therefore, the requirements of Section 4(f) have been satisfied.

_____
Federal Highway Administration

_____
Project Manager - HOYLE, TANNER & ASSOCIATES, INC.

_____
US Army Corps of Engineers

Cc: FHWA, NHDHR, ACOE (⇐ as applicable ⇑)

Theriault, Joanne E.

From: Edelmann, Jillian <Jillian.Edelmann@dot.nh.gov>
Sent: Friday, July 19, 2019 10:36 AM
To: Peace, Kimberly R.; Charles, Sheila; Crickard, Ronald; Urban, Matt
Cc: 092592.02 - NHDOT Statewide Env #41768 Peterboro NEPA Re-Eval
Subject: RE: Env On Call 41768 Task 2, Peterborough 101 NEPA Re-Evaluation

We agree that temporary fill locations do not need to be reevaluated for S106.

Jill Edelmann
Cultural Resources Manager, NHDOT

*NOTE: As of October 31, 2016 all NHDOT emails have changed. Please update any contact lists.

From: Peace, Kimberly R. [mailto:kpeace@hoyletanner.com]
Sent: Friday, July 19, 2019 10:19 AM
To: Edelmann, Jillian; Charles, Sheila; Crickard, Ronald; Urban, Matt
Cc: 092592.02 - NHDOT Statewide Env #41768 Peterboro NEPA Re-Eval
Subject: RE: Env On Call 41768 Task 2, Peterborough 101 NEPA Re-Evaluation

Hi Jill and Sheila- I don't believe I have received a response from you on this project, can you please provide comment soon? Thank you-

Kimberly R. Peace
Senior Environmental Coordinator
Hoyle, Tanner & Associates, Inc.
(603) 669-5555, ext 151 | Cell: (603) 716-3343

From: Peace, Kimberly R.
Sent: Tuesday, July 02, 2019 1:13 PM
To: Edelmann, Jillian <Jillian.Edelmann@dot.nh.gov>; Charles, Sheila <Sheila.Charles@dot.nh.gov>; Crickard, Ronald <Ronald.Crickard@dot.nh.gov>; Urban, Matt <Matt.Urban@dot.nh.gov>
Cc: 092592.02 - NHDOT Statewide Env #41768 Peterboro NEPA Re-Eval <092592.02-NHDOTStatewideEnv#41768PeterboroNEPARe-Eval@hoyletanner.onmicrosoft.com>
Subject: FW: Env On Call 41768 Task 2, Peterborough 101 NEPA Re-Evaluation

Hi Jill and Sheila- Ron suggested I include you on this email discussion to receive your input. Please let me know if you have any questions, thanks-

Kimberly R. Peace
Senior Environmental Coordinator
Hoyle, Tanner & Associates, Inc.
(603) 669-5555, ext 151 | Cell: (603) 716-3343

From: Peace, Kimberly R.
Sent: Tuesday, July 02, 2019 12:16 PM
To: Crickard, Ronald <Ronald.Crickard@dot.nh.gov>; Urban, Matt <Matt.Urban@dot.nh.gov>; Low, Matthew J., PE <mlow@hoyletanner.com>; Beaulac, Audrey G. <abeaulac@hoyletanner.com>; Monette, Stephanie <Stephanie.Monette@dot.nh.gov>
Cc: 092592.02 - NHDOT Statewide Env #41768 Peterboro NEPA Re-Eval <092592.02-NHDOTStatewideEnv#41768PeterboroNEPARe-Eval@hoyletanner.onmicrosoft.com>
Subject: Env On Call 41768 Task 2, Peterborough 101 NEPA Re-Evaluation

Hi Ron and Matt- here's an update on the NEPA re-evaluation, along with some questions. The design team, in coordination with DOT, has identified the project work limits with respect to dealing with LRS soils. As shown on the attached figure, we will need to create a temporary LRS stockpile in a location that is outside of the project area that was reviewed during the initial NEPA analysis.

Matt, your comments on the scope noted that the CR staff didn't think Section 106 needed to be re-evaluated as long as there are no additional limits of excavation. The proposed LRS temporary stockpile location would involve "fill" placed at and above grade, and only temporary, so I believe we will not need to go back to CR or NHDHR for additional analysis, do you agree?

The location is in a DOT ROW and is a mowed grass roadside area- I attached a clear aerial so that you can see existing conditions- there will be no tree removal required, no change in water flows (the swale will not be affected), and the area will revert to existing conditions after the project is completed. Assuming we would adhere to required BMPs for erosion and sediment control and stockpiling, there wouldn't be water quality impacts.

I will address all Cat Ex resources in the re-evaluation memo, but in short: the area is not located near Section 4(f) or 6(f) properties, is not in a FEMA Mapped floodplain or floodway, is not in a wetland, lies just outside of Designated River corridor and protected Shoreland, is not habitat that state-listed species of special concern wood turtle would use, and would not affect the EFH assessment. I am still checking the PFAS map but there is no obvious reason that pops out for concern.

Per the scope of work, we plan to update the NHNHB and IPAC lists- should we include this area in the project limits? I will ask NMFS/NOAA if the existing EFH Analysis is still valid, there is no reason for including this area to change that since water quality will not be affected. I will not coordinate with OEP since the area is outside of what is shown on the FIRM mapping. We didn't scope for coordination with LCHIP or LWCF, and I don't think it is needed for this site since we can review the Peterborough GIS mapping, but let me know if you agree/disagree.

Thank you, and enjoy your holiday-

Kimberly R. Peace
Senior Environmental Coordinator

Hoyle, Tanner & Associates, Inc.

Responsive. Consistent. Competent.™

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(603) 669-5555, ext 151 | Cell: (603) 716-3343
kpeace@hoyletanner.com
www.hoyletanner.com

Our vision is to provide innovative, collaborative and sustainable engineering and planning solutions to the challenges our clients face, while enhancing the communities in which we work and live. We strive to uphold the highest ethical

standards while maintaining integrity and respect within our professional relationships. We continue to build a corporate culture that honors and values the individuality and strengths of our team members and our clients.

Hoyle, Tanner & Associates, Inc. | info@hoyletanner.com

Attachment I

ACOE - Appendix B

US Army Corps of Engineers®
New England District

New Hampshire General Permits (GPs)
Appendix B - Corps Secondary Impacts Checklist
(for inland wetland/waterway fill projects in New Hampshire)

1. Attach any explanations to this checklist. Lack of information could delay a Corps permit determination.
2. All references to "work" include all work associated with the project construction and operation. Work includes filling, clearing, flooding, draining, excavation, dozing, stumping, etc.
3. See GC 5, regarding single and complete projects.
4. Contact the Corps at (978) 318-8832 with any questions.

1. Impaired Waters	Yes	No
1.1 Will any work occur within 1 mile upstream in the watershed of an impaired water? See http://des.nh.gov/organization/divisions/water/wmb/section401/impaired_waters.htm to determine if there is an impaired water in the vicinity of your work area.*	X	
2. Wetlands	Yes	No
2.1 Are there are streams, brooks, rivers, ponds, or lakes within 200 feet of any proposed work?	X	
2.2 Are there proposed impacts to SAS, special wetlands. Applicants may obtain information from the NH Department of Resources and Economic Development Natural Heritage Bureau (NHB) DataCheck Tool for information about resources located on the property at https://www2.des.state.nh.us/nhb_datacheck/. The book Natural Community Systems of New Hampshire also contains specific information about the natural communities found in NH.		X
2.3 If wetland crossings are proposed, are they adequately designed to maintain hydrology, sediment transport & wildlife passage?	X	
2.4 Would the project remove part or all of a riparian buffer? (Riparian buffers are lands adjacent to streams where vegetation is strongly influenced by the presence of water. They are often thin lines of vegetation containing native grasses, flowers, shrubs and/or trees that line the stream banks. They are also called vegetated buffer zones.)		X
2.5 The overall project site is more than 40 acres?		X
2.6 What is the area of the previously filled wetlands?	0.044 ac.	
2.7 What is the area of the proposed fill in wetlands?	0.036 ac.	
2.8 What is the % of previously and proposed fill in wetlands to the overall project site?	N/A	
3. Wildlife	Yes	No
3.1 Has the NHB & USFWS determined that there are known occurrences of rare species, exemplary natural communities, Federal and State threatened and endangered species and habitat, in the vicinity of the proposed project? (All projects require an NHB ID number & a USFWS IPAC determination.) NHB DataCheck Tool: https://www2.des.state.nh.us/nhb_datacheck/ USFWS IPAC website: https://ecos.fws.gov/ipac/location/index	X	

3.2 Would work occur in any area identified as either "Highest Ranked Habitat in N.H." or "Highest Ranked Habitat in Ecological Region"? (These areas are colored magenta and green, respectively, on NH Fish and Game's map, "2010 Highest Ranked Wildlife Habitat by Ecological Condition.") Map information can be found at: • PDF: www.wildlife.state.nh.us/Wildlife/Wildlife_Plan/highest_ranking_habitat.htm. • Data Mapper: www.granit.unh.edu. • GIS: www.granit.unh.edu/data/downloadfreedata/category/databycategory.html.		X
3.3 Would the project impact more than 20 acres of an undeveloped land block (upland, wetland/waterway) on the entire project site and/or on an adjoining property(s)?		X
3.4 Does the project propose more than a 10-lot residential subdivision, or a commercial or industrial development?		X
3.5 Are stream crossings designed in accordance with the GC 21?	X	
4. Flooding/Floodplain Values	Yes	No
4.1 Is the proposed project within the 100-year floodplain of an adjacent river or stream?	X	
4.2 If 4.1 is yes, will compensatory flood storage be provided if the project results in a loss of flood storage?		X
5. Historic/Archaeological Resources		
For a minimum, minor or major impact project - a copy of the Request for Project Review (RPR) Form (www.nh.gov/nhdhr/review**)** with your DES file number shall be sent to the NH Division of Historical Resources as required on Page 11 GC 8(d) of the GP document**	X	

*Although this checklist utilizes state information, its submittal to the Corps is a Federal requirement.
** If your project is not within Federal jurisdiction, coordination with NH DHR is not required under Federal law.
`

Attachment J

Color Photos

Peterborough, X-A001(007), 15879
US Route 202/ NH Route 101 Bridge
Standard Dredge and Fill Application

NORTH

Granite Street/
US Route 202

Contoocook River

Walking Path

NH Route 101

Wilton Road

US Route 202

Walking Path

Contoocook River

Plaza Entrance

20 0 20 40
SCALE IN FEET

Peterborough
Shopping Plaza
and Parking Area

North- Contoocook River; View from North Side of Bridge. Impact # 1 & 2 to Wetland # E & A1

Contoocook River and Walkpath; View from South Side of Bridge. Impact # 9 & 10 to Wetland # F & A2

South Side of Bridge; View from South-Western Bank. Impact # 9 &10 to Wetland # F & A2

South-Eastern Bank; View from South-Western Bank. Impact #10, 11, & 12 to Wetland # A2, C, & G

South- Contoocook River; View from South-Western Bank. Impact #10 to Wetland # F & A2

North Side of Bridge; View from North-Western Bank. Impact #2 & 3 to Wetland # A1 & G

South Side of Bridge; View from South-Eastern Bank. Impact #11 to Wetland # G

Shopping Plaza & Walkpath; View from South-Eastern Bank. Impact #9 & 10 to Wetland # F & A2

Shopping Plaza; View from South-Eastern Bank. Impact #9 & 10 to Wetland #F & A2

Walkpath; View from North-Eastern Bank. Impact #1 & 2 to Wetland #E & A1

North-Western Bank; View from North-Eastern Bank. Impact #2 & 3 to Wetland # G & A1

Attachment K

Construction Sequence Narrative

15879 Construction Sequence
US ROUTE 202 & NH ROUTE 101 OVER THE CONTOOCOOK RIVER
Peterborough, NH

Although ultimate means and methods will be determined by the Contractor it is anticipated the Contractor's approach will be as follows:

1. Sediment, erosion control and construction water quality features will be put in place.
2. Phased traffic management controls will be put in place to begin phased bridge work.
3. Once traffic controls are in place the closed portion of the bridge will be demolished and removed.
4. Once the existing bridge is removed then abutment, foundation and driving/drilling for the foundations will occur.
5. The superstructure will be placed along with the new bridge rail.
6. Traffic phases will be changed and items numbered 4. and 5. will be completed for the next phase of the bridge.
7. The bridge joints will be completed and approach paving will be placed.
8. Drainage and signal work will then be completed.
9. Final construction tasks, paving and striping will be completed.

Attachment L

EFH Study and NMFS Correspondence

EFH ASSESSMENT WORKSHEET FOR FEDERAL AGENCIES (modified 08/04)

PROJECT NAME: Peterborough

DATE: January 29, 2014

PROJECT NO.: 15879

LOCATION: US Route 202/NH Route 101 over the Contoocook River, Peterborough, NH

PREPARER: M. Lundsted

Project Description: The project proposes to replace Bridge No 087/077 on US Route 202/NH Route 101. The bridge is located over the Contoocook River and was constructed in 1958 by NHDOT as an extension of the existing NH Route 101. The bridge is on the NHDOT Red List. The existing three span bridge will be replaced with a new two span structure within a similar footprint as the existing bridge. The replacement bridge will be wider than the existing bridge due to construction and traffic needs.

The two existing bridge piers will be replaced with a single open pier constructed in a location between the existing piers. The new pier will be longer than the original to accommodate the new and wider bridge superstructure (concrete deck and steel girders) and will consist of four columns spaced at 18'-9". The two existing bridge solid piers will be removed in their entirety. New wider bridge abutments will be constructed in close proximity to the existing abutments to accommodate the proposed bridge geometry.

The bridge replacement will be completed in two construction phases. Removal of approximately 1/3 of the existing bridge and upstream widening will be accomplished during phase 1. Traffic will be placed on the newly constructed portion of the bridge while the remaining existing section of the bridge is to be removed and replaced. The river reach and adjacent banks will be re-established upon completion of construction.

Restoration of exposed streambed areas after pier removal and completion of construction efforts may include grading and/or replacement of suitably sized stone fill to match existing upstream and downstream streambed conditions; restoration efforts will be reviewed and finalized during the wetland application process during Final Design of the project..

The Contoocook River is Essential Fish Habitat for juvenile and adult Atlantic salmon.

Step 1. Use the Habitat Conservation Division EFH webpage, Guide to Essential Fish Habitat Designations in the Northeastern United States to generate the list of designated EFH for federally-managed species for the geographic area of interest (http://www.nero.noaa.gov/hcd/index2a.htm). Use the species list as part of the initial screening process to determine if EFH for those species occurs in the vicinity of the proposed action. Attach that list to the worksheet because it will be used in later steps. Make a preliminary determination on the need to conduct an EFH Consultation.

1. INITIAL CONSIDERATIONS		
EFH Designations	**Yes**	**No**
Is the action located in or adjacent to EFH designated for eggs?		X
Is the action located in or adjacent to EFH designated for larvae?		X
Is the action located in or adjacent to EFH designated for juveniles?	X	
Is the action located in or adjacent to EFH designated for adults?	X	
Is the action located in or adjacent to EFH designated for spawning adults?		X
If you answered no to all questions above, then EFH consultation is not required -go to Section 5. If you answered yes to any of the above questions proceed to Section 2 and complete remainder of the worksheet.		

Step 2. In order to assess impacts, it is critical to know the habitat characteristics of the site before the activity is undertaken. Use existing information, to the extent possible, in answering these questions. Please note that, there may be circumstances in which new information must be collected to appropriately characterize the site and assess impacts.

2. SITE CHARACTERISTICS	
Site Characteristics	**Description**
Is the site intertidal, sub-tidal, or water column?	**Water Column**
What are the sediment characteristics?	**Alluvial; characterized as mostly very coarse gravel with nearly 25% cobbles.**
Is Habitat Area of Particular Concern (HAPC) designated at or near the site? If so what type, size, characteristics?	**No; See attached maps (attached as "Figures 10.2 and 10.3") and Merrimack River Essential Fish Habitat Designation.**
Is there submerged aquatic vegetation (SAV) at or adjacent to project site? If so describe the spatial extent.	**No submerged aquatic vegetation observed.**
What is typical salinity and temperature regime/range?	**The Contoocook River is a freshwater river. Salinity concentrations vary at the project location due to salt application for road maintenance.** **Chloride range 17-24 mg/l** **Water temperature range: 4 - 23 °c** **(Source: New Hampshire Volunteer River Assessment Program 2007 Contoocook River Water Quality Report.)**
What is the normal frequency of site disturbance, both natural and man-made?	**There is no regular typical disturbance at the project location beyond recreational boating and fishing. The Contoocook River (tributary to the Merrimack River) has twenty-five dams located on it. The Hopkinton-Everett Dam in Hopkinton is used for flood control purposes, two dams in Jaffrey are used for storage and fifteen dams are used for hydroelectric power, including one on the North Branch. The remaining dams in the river are listed as inactive.**
What is the area of proposed impact (work footprint & far afield)?	**Detailed project impacts will not be quantified until final design of the project. Pending final design it is anticipated that approximately 6000 s.f. of temporary impacts in total throughout all phases of construction. Please note that a net reduction in permanent impact area to the streambed will be achieved by removal of the two existing piers (approx. 192 s.f.) and additional of the proposed single pier line (approx. 113 s.f.). The approximate footprint of the entire project is 127,300 s.f. (2.92 acres) including roadway and approach work.**

Step 3. This section is used to describe the anticipated impacts from the proposed action on the physical/chemical/biological environment at the project site and areas adjacent to the site that may be affected.

3. DESCRIPTION OF IMPACTS			
Impacts	**Y**	**N**	**Description**
Nature and duration of activity(s)			**Removal of two existing piers and installation of a new single pier will occur over approximately two construction seasons (two years).**
Will benthic community be disturbed?	**X**		**Portions of the river bed will be temporarily disturbed during removal of existing piers and installation of the new pier.**
Will SAV be impacted?		**X**	**No observed SAV.**
Will sediments be altered and/or sedimentation rates change?	**X**		**With the implementation of a Storm Water Pollution Prevention Plan (SWPPP) and appropriate Best Management Practices, sediments and sedimentation will only minimally be altered during construction. The project is not expected to result in any permanent changes to sedimentation rates following construction.**
Will turbidity increase?		**X**	**With the implementation of a SWPPP and appropriate Best Management Practices, turbidity will not increase beyond acceptable levels during or following construction.**
Will water depth change?		**X**	**Water depth will not change as a result of this project.**
Will contaminants be released into sediments or water column?		**X**	**With the implementation of a SWPPP and appropriate Best Management Practices, contaminants will not be released during construction. All construction debris will be prevented from falling into the water.**
Will tidal flow, currents or wave patterns be altered?	**X**		**Since the project will replace the existing two piers with one pier in a new location, there will be slight changes in river currents through the bridge. These changes, however, should be minimal and are not expected to impact habitat quality.**
Will ambient salinity or temperature regime change?		**X**	**There will be no change in salinity or temperature regimes as a result of the construction of this project.**

Will water quality be altered?		**X**	**With the implementation of a SWPPP and appropriate Best Management Practices, water quality will not be altered during or following construction.**

Step 4. This section is used to evaluate the consequences of the proposed action on the functions and values of EFH as well as the vulnerability of the EFH species and their life stages. Identify which species from the EFH species list (generated in Step 1) will be adversely impacted from the action. Assessment of EFH impacts should be based upon the site characteristics identified in Step 2 and the nature of the impacts described within Step 3. The Guide to EFH Descriptions webpage (http://www.nero.noaa.gov/hcd/list.htm) should be used during this assessment to determine the ecological parameters/preferences associated with each species listed and the potential impact to those parameters.

4. EFH ASSESSMENT			
Functions and Values	**Y**	**N**	**Describe habitat type, species and life stages to be adversely impacted**
Will functions and values of EFH be impacted for:			
Spawning		**X**	
Nursery	**X**		**Temporary impacts to habitat will occur during construction.**
Forage	**X**		**Temporary impacts to habitat will occur during construction.**
Shelter	**X**		**Temporary impacts to habitat will occur during construction.**
Will impacts be temporary or permanent?			**Pending final design it is anticipated that approximately 6000 s.f. of temporary impacts in total throughout all phases of construction. Please note that a net reduction in permanent impact area to the streambed will be achieved by removal of the two existing piers (approx. 192 s.f.) and additional of the proposed single pier line (approx. 113 s.f.).**
Will compensatory mitigation be used?		**X**	**The project's limited impacts do not warrant mitigation.**

Step 5. This section provides the Federal agency=s determination on the degree of impact to EFH from the proposed action. The EFH determination also dictates the type of EFH consultation that will be required with NOAA Fisheries.

5. DETERMINATION OF IMPACT		
	/	**Federal Agency=s EFH Determination**
Overall degree of adverse effects on EFH (not including compensatory mitigation) will be: **(check the appropriate statement)**		**There is no adverse effect on EFH** **EFH Consultation is not required**
	X	**The adverse effect on EFH is not substantial.** **This is a request for an abbreviated EFH consultation. This worksheet is being submitted to NMFS to satisfy the EFH Assessment requirement.**
		The adverse effect on EFH is substantial. **This is a request for an expanded EFH consultation. A detailed written EFH assessment will be submitted to NMFS expanding upon the impacts revealed in this worksheet.**

Step 6. Consultation with NOAA Fisheries may also be required if the proposed action results in adverse impacts to other NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats. Some examples of other NOAA-trust resources are listed below. Inquiries regarding potential impacts to marine mammals or threatened/endangered species should be directed to NOAA Fisheries' Protected Resources Division.

6. OTHER NOAA-TRUST RESOURCES IMPACT ASSESSMENT	
Species known to occur at site (list others that may apply)	**Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat).**
alewife	**n/a**
blueback herring	**n/a**
rainbow smelt	**n/a**
Atlantic sturgeon	**n/a**
Atlantic menhaden	**n/a**
American shad	**n/a**
American eel	**n/a**
American lobster	**n/a**
blue mussels	**n/a**
soft-shell clams	**n/a**
quahog	**n/a**
Other species:	

Essential Fish Habitat
Atlantic salmon (*Salmo salar*) Juveniles

Figure 10.2: The EFH designation for Atlantic salmon juveniles represents all rivers where Atlantic salmon are currently present [26 rivers]. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic salmon juveniles at the "abundant", "common" or "rare" level. This alternative was selected to ensure that all rivers currently capable of supporting Atlantic salmon are included in the EFH designation. The guidance in the Interim Final Rule directs that for overfished species where habitat loss or degradation may be contributing to the overfished condition, all habitats currently used by the species should be considered essential. The rivers from which Atlantic salmon have been extirpated were not selected as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking.

Essential Fish Habitat
Atlantic salmon (*Salmo salar*) Adults

Figure 10.3: The EFH designation for Atlantic salmon adults represents all rivers where Atlantic salmon are currently present [26 rivers]. This designation also includes those bays and estuaries identified by the NOAA ELMR program as supporting Atlantic salmon adults at the "abundant", "common" or "rare" level. This alternative was selected to ensure that all rivers currently capable of supporting Atlantic salmon are included in the EFH designation. The guidance in the Interim Final Rule directs that for overfished species where habitat loss or degradation may be contributing to the overfished condition, all habitats currently used by the species should be considered essential. The rivers from which Atlantic salmon have been extirpated were not selected as EFH on the presumption that it would be extremely unlikely that these rivers will again support Atlantic salmon without artificial supplementation or stocking.

Summary of Essential Fish Habitat (EFH) Designations

Name of Estuary/ Bay/ River: **Merrimack River, Massachusetts**

10min x 10min latitude and longitude squares included in this bay or estuary or river (southeast corner boundaries):

4250/7040; 4250/7050; 4240/7040; 4240/7050; 4240/7100; 4240/7110

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Atlantic salmon *(Salmo salar)*			F,M	F,M	
Atlantic cod *(Gadus morhua)*					
haddock *(Melanogrammus aeglefinus)*					
pollock *(Pollachius virens)*	M	M	M		
whiting *(Merluccius bilinearis)*	M				
offshore hake *(Merluccius albidus)*					
red hake *(Urophycis chuss)*					
white hake *(Urophycis tenuis)*	M				
redfish *(Sebastes fasciatus)*	n/a				
witch flounder *(Glyptocephalus cynoglossus)*					
winter flounder *(Pleuronectes americanus)*	M	M	M	M	M
yellowtail flounder *(Pleuronectes ferruginea)*	S	S			
windowpane flounder *(Scopthalmus aquosus)*					
American plaice *(Hippoglossoides platessoides)*					
ocean pout *(Macrozoarces americanus)*					
Atlantic halibut *(Hippoglossus hippoglossus)*	S	S	S	S	S

Atlantic sea scallop *(Placopecten magellanicus)*					
Atlantic sea herring *(Clupea harengus)*		M	M		
monkfish *(Lophius americanus)*					
bluefish *(Pomatomus saltatrix)*					
long finned squid *(Loligo pealei)*	n/a	n/a			
short finned squid *(Illex illecebrosus)*	n/a	n/a			
Atlantic butterfish *(Peprilus triacanthus)*					
Atlantic mackerel *(Scomber scombrus)*	M	M			
summer flounder *(Paralicthys dentatus)*					
scup *(Stenotomus chrysops)*					
black sea bass *(Centropristus striata)*					
surf clam *(Spisula solidissima)*	n/a	n/a			
ocean quahog *(Artica islandica)*	n/a	n/a			
spiny dogfish *(Squalus acanthias)*	n/a	n/a			
tilefish *(Lopholatilus chamaeleonticeps)*					

Theriault, Joanne E.

Subject: EFH Assessment, Peterborough Route 101 Bridge Replacement, NEPA Re-Evaluation

From: Mike R Johnson - NOAA Federal [mailto:mike.r.johnson@noaa.gov]
Sent: Tuesday, July 30, 2019 9:54 AM
To: Peace, Kimberly R. <kpeace@hoyletanner.com>
Subject: Re: EFH Assessment, Peterborough Route 101 Bridge Replacement, NEPA Re-Evaluation

Kimberly,

Thanks, I'm able to see the two areas in this one.

Assuming the material placed in the temporary stockpile area is not conveyed into the river and increase turbidity, we concur that the change in the project design will not have more than minimal adverse effect and the previous consultation is valid.

Mike

On Mon, Jul 29, 2019 at 4:46 PM Peace, Kimberly R. <kpeace@hoyletanner.com> wrote:

> Hi Mike-
>
> The Peterborough Route 101 Bridge over the Contoocook River is proposed for replacement. A NHDOT/FHWA Cat Ex was completed for this project in 2014. Due to the lapse of time, and the changes in environmental review requirements since then, NHDOT is re-evaluating the Cat Ex document.
>
> The project area has been revised slightly to include a temporary stockpile location for Limited Reuse Soils (LRS), as shown on the attached figure: the area in red was the project area used for the Cat Ex review process, and the area in blue is the addition to the project area. The area of temporary impact is located within a mowed DOT right-of-way, is upland, and is approximately 0.25 miles away from the Contoocook River.
>
> I have attached your correspondence with Christine Perron during the 2014 Cat Ex, who was the DOT Bureau of Environment staff running the NEPA process at the time. Please let me know if you believe the addition to the project area necessitates re-evaluation of the EFH Assessment for the project, or if you are satisfied that the existing analysis was complete, and the proposed use of NHDOT BMPs an implementation of a SWPPP will be sufficient to serve as protection of the habitat, or if you would like additional information or a revised EFH Assessment to be developed.
>
> Thank you-
>
> **Kimberly R. Peace**
> Senior Environmental Coordinator
>
> Hoyle, Tanner & Associates, Inc.
> Responsive. Consistent. Competent.™
> 150 Dow Street | Manchester, NH 03101

(603) 669-5555, ext 151 | Cell: (603) 716-3343
kpeace@hoyletanner.com
www.hoyletanner.com

Our vision is to provide innovative, collaborative and sustainable engineering and planning solutions to the challenges our clients face, while enhancing the communities in which we work and live. We strive to uphold the highest ethical standards while maintaining integrity and respect within our professional relationships. We continue to build a corporate culture that honors and values the individuality and strengths of our team members and our clients.

Attachment M

Local River Council Correspondence

MEETING MEMO

Attendees: Beth Alpaugh-Cote, Local Advisory Committee
Matt Lundsted, P.E., Comprehensive Environmental Inc.- Project Manager

Notes by: Matt Lundsted, P.E.

Subject: Peterborough 15879- Replacement of Rte 101/Rte 202 over the Contoocook River

Job No. 660-3

Meeting Date: 8/13/12

The representative from the Local Advisory Committee (LAC) for the Contoocook River, Beth Alpaugh-Cote and CEI's representative Matt Lundsted met at the proposed project site to discuss potential impacts to the river. The purpose of the meeting was to present an overview of the proposed project to the LAC representative. Mr. Lundsted presented draft plans of the proposed bridge widening to Mrs. Alpaugh-Cote for review. Mr. Lundsted explained that the project proposes to replace the existing bridge deck and girders, since the bridge is on the DOT's Red List and in need of rehabilitation. In order to facilitate phasing of the project in order to maintain adequate traffic patterns, permanent bridge widening is required.

Mr. Lundsted gave Mrs. Alpaugh-Cote a tour of the project site explaining what the proposed work will include. On the upstream side of the bridge abutments and piers will be extended in-kind approximately 20 feet to facilitate the bridge widening. Impacts to the river will be temporary in nature, related to construction and will not permanently change the channel or banks significantly. Mr. Lundsted also explained that water quality improvements (BMPs) will be installed as part of the project and will be an improvement over the current level of treatment storm water receives prior to discharge to the river. Infiltration type BMPs will be installed which mitigate the increases in impervious surfaces associated with the widening of the bridge approaches.

Mrs. Alpaugh-Cote noted that the LAC's only concern would be protecting the river from deposition of any demolition debris. Mr. Lundsted explained that standard practices would be employed during construction to ensure that no debris enters the river. At any point if any debris drops into the river by mistake it will be immediately removed by the Contractor.

The above text summarizes the events of the meeting at the above date and time.
If this information is not correct, please contact me as soon as possible.

Attachment N

ACOE Wetland Determination Data Form

WETLAND DETERMINATION DATA FORM – Northcentral and Northeast Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	**Is the Sampled Area within a Wetland? Yes _____ No _____** If yes, optional Wetland Site ID: _____

Remarks: (Explain alternative procedures here or in a separate report.)

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ Marl Deposits (B15)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION – Use scientific names of plants. Sampling Point: _____

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species _____	x 3 = _____
FACU species _____	x 4 = _____
UPL species _____	x 5 = _____
Column Totals: _____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ Rapid Test for Hydrophytic Vegetation

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Vegetation Strata:

Tree – Woody plants 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub – Woody plants less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vines – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** _____ **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7) (**LRR R, MLRA 149B**)
- ___ Polyvalue Below Surface (S8) (**LRR R, MLRA 149B**)
- ___ Thin Dark Surface (S9) (**LRR R, MLRA 149B**)
- ___ Loamy Mucky Mineral (F1) (**LRR K, L**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) (**LRR K, L, MLRA 149B**)
- ___ Coast Prairie Redox (A16) (**LRR K, L, R**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR K, L, R**)
- ___ Dark Surface (S7) (**LRR K, L**)
- ___ Polyvalue Below Surface (S8) (**LRR K, L**)
- ___ Thin Dark Surface (S9) (**LRR K, L**)
- ___ Iron-Manganese Masses (F12) (**LRR K, L, R**)
- ___ Piedmont Floodplain Soils (F19) (**MLRA 149B**)
- ___ Mesic Spodic (TA6) (**MLRA 144A, 145, 149B**)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No _____

Remarks:

Attachment O

Wetland Impact Plans

Stabilization Details

Erosion Control Plans

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

WETLANDS PLANS

FEDERAL AID PROJECT

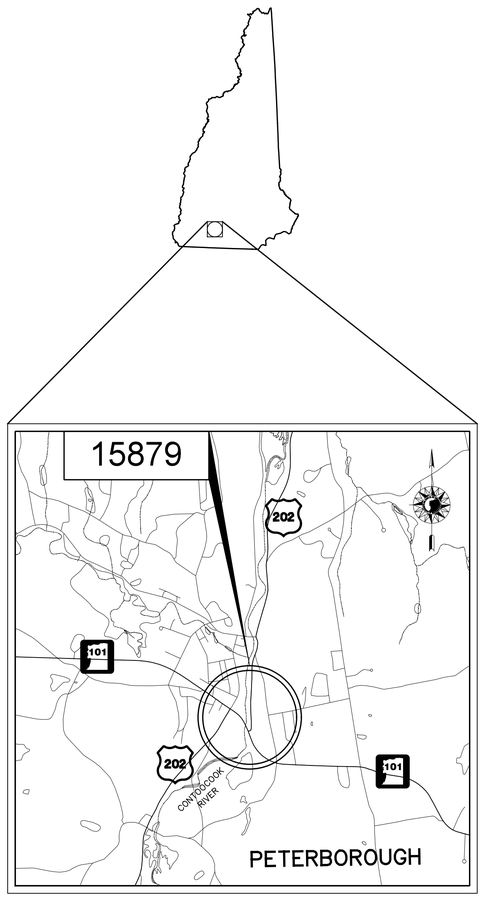
X-A001(007)
N.H. PROJECT NO. 15879
US RTE 202 & NH RTE 101 OVER CONTOOCOOK RIVER

DESIGN DATA	
AVERAGE DAILY TRAFFIC 20 18	16,500
AVERAGE DAILY TRAFFIC 20 38	20,100
PERCENT OF TRUCKS	2.1%
DESIGN SPEED	35/40 MPH
LENGTH OF PROJECT	1400 LF

WILLIAM E. KURIGER
STATE OF NEW HAMPSHIRE
No. 069
CERTIFIED WETLAND SCIENTIST

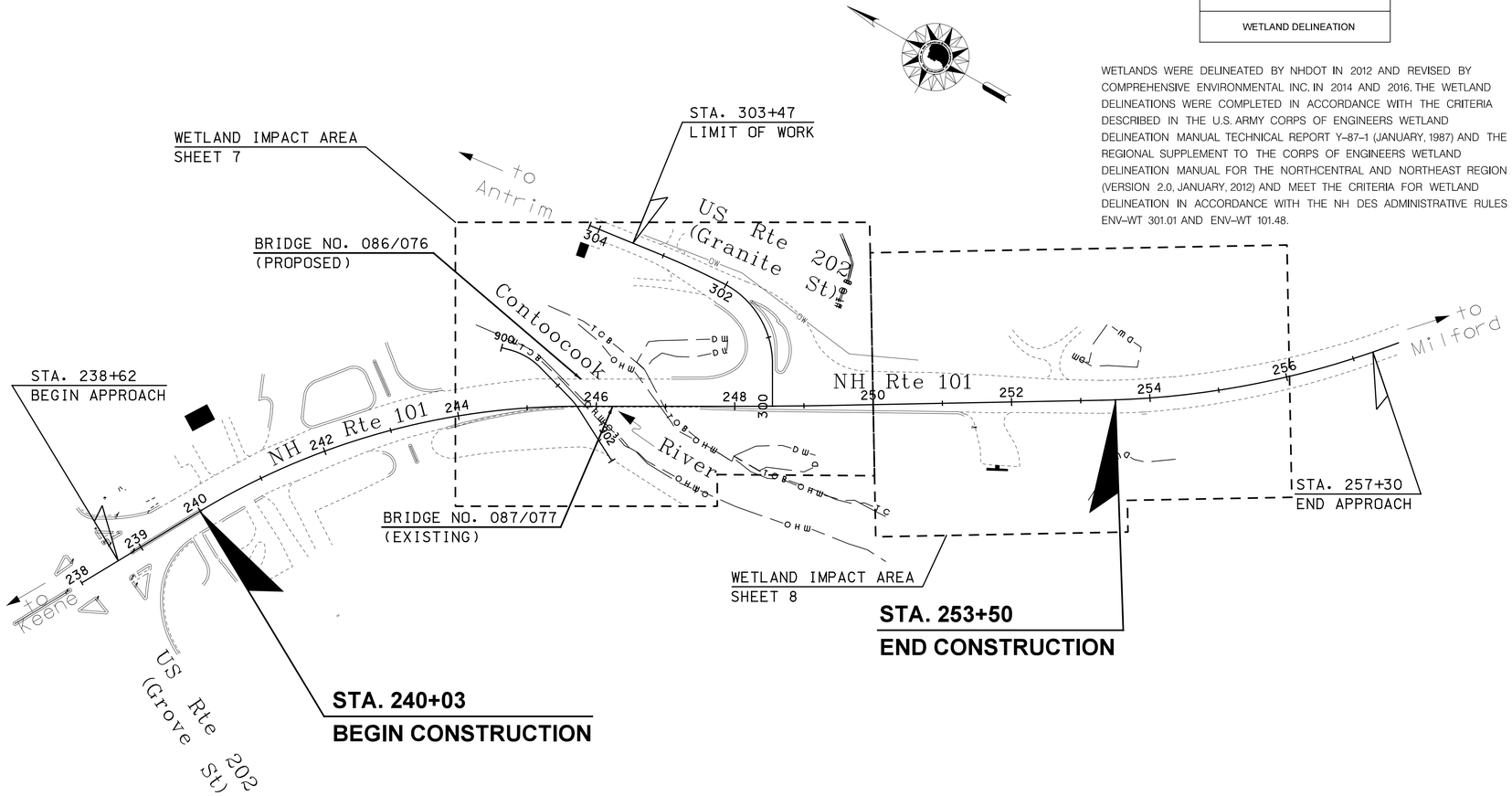
WETLAND DELINEATION

WETLANDS WERE DELINEATED BY NHDOT IN 2012 AND REVISED BY COMPREHENSIVE ENVIRONMENTAL INC. IN 2014 AND 2016. THE WETLAND DELINEATIONS WERE COMPLETED IN ACCORDANCE WITH THE CRITERIA DESCRIBED IN THE U.S. ARMY CORPS OF ENGINEERS WETLAND DELINEATION MANUAL TECHNICAL REPORT Y-87-1 (JANUARY, 1987) AND THE REGIONAL SUPPLEMENT TO THE CORPS OF ENGINEERS WETLAND DELINEATION MANUAL FOR THE NORTHCENTRAL AND NORTHEAST REGION (VERSION 2.0, JANUARY, 2012) AND MEET THE CRITERIA FOR WETLAND DELINEATION IN ACCORDANCE WITH THE NH DES ADMINISTRATIVE RULES ENV-WT 301.01 AND ENV-WT 101.48.



LOCATION MAP

1/2 0 1/2 1
SCALE IN MILES



DRAWN BY AGB DATE 11/2019
CHECKED BY TMC DATE 11/2019

INDEX OF SHEETS

TOWN OF PETERBOROUGH

COUNTY OF HILLSBOROUGH

SCALE: 1"=100'

FOR CONSTRUCTION AND ALIGNMENT DETAILS - SEE THE CONSTRUCTION PLANS

Hoyle, Tanner & Associates, Inc.

COMPREHENSIVE ENVIRONMENTAL INC.

NHDOT THE STATE OF NEW HAMPSHIRE DEPARTMENT OF TRANSPORTATION

RECOMMENDED FOR APPROVAL:

DIRECTOR OF PROJECT DEVELOPMENT — DATE

APPROVED:

ASSISTANT COMMISSIONER AND CHIEF ENGINEER — DATE

HTA PROJECT NO.	MODEL	FEDERAL PROJECT NO.	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	TITLE SHEET	X-A001(007)	15879	1	12

GENERAL

	PROPOSED ROADWAY	existing roadway	(pavement removed outside slope lines)
EDGE OF PAVEMENT			
TRAVELED WAY			

DRIVEWAYS (label surface type)

BUILDINGS (label house or type of building) (building to be removed)

FOUNDATION (label type)

LEACH FIELD — leach field

BRIDGE CROSSINGS — STREAM, OVERPASS

STEPS AND WALK (label type)

INTERMITTENT WATER COURSE

SHORE LINE — river/stream, pond (label name of water body)

POTENTIAL WET AREA SYMBOL

BRUSH OR WOODS LINE

TREES (PLANS) — (deciduous) (coniferous) (stump)

(show station, circumference in feet & type)

TREE OR STUMP (CROSS-SECTIONS)

HEDGE (label type)

MONITORING WELL — mon

WELL

FLAG POLE — fp

ORIGINAL GROUND (TYPICALS)

ROCK OUTCROP

ROCK LINE (TYPICALS & SECTIONS ONLY)

	existing	PROPOSED
GUARDRAIL (label type)	bgr, cgr	
JERSEY BARRIER		
CURB (LABEL TYPE)		
STONE WALL		
RETAINING WALL (LABEL TYPE)		(points toward retained ground)
FENCE (LABEL TYPE)		

SIGNS — (single post), (double post)

GAS PUMP — gp

FUEL TANK (ABOVE GROUND) — ft (label size & type)

STORAGE TANK FILLER CAP — fc

SEPTIC TANK — S

GRAVE — gr

MAILBOX — mb

VENT PIPE — vp

SATELLITE DISH ANTENNA — da

PHONE — ph

GROUND LIGHT/LAMP POST — gl, lp

BORING LOCATION — B

TEST PIT — TP

INTERSTATE NUMBERED HIGHWAY — 293

UNITED STATES NUMBERED HIGHWAY — 3

STATE NUMBERED HIGHWAY — 102

SHORELAND - WETLAND

WETLAND DESIGNATION AND TYPE	2 PUB2E
DELINEATED WETLAND	DW
ORDINARY HIGH WATER	OHW
TOP OF BANK	TOB
TOP OF BANK & ORDINARY HIGH WATER	TOBOHW
NORMAL HIGH WATER	NHW
WIDTH AT BANK FULL	WBF
PRIME WETLAND	PWET
PRIME WETLAND 100' BUFFER	PWET100
NON-JURISDICTIONAL DRAINAGE AREA	NJDA
COWARDIN DISTINCTION LINE	COL
TIDAL BUFFER ZONE	TBZ
DEVELOPED TIDAL BUFFER ZONE	DTBZ
HIGHEST OBSERVABLE TIDE LINE	HOTL
MEAN HIGH WATER	MHW
MEAN LOW WATER	MLW
VERNAL POOL	VP
SPECIAL AQUATIC SITE	SAS
REFERENCE LINE	REF
WATER FRONT BUFFER	WB50
NATURAL WOODLAND BUFFER	NWB150
PROTECTED SHORELAND	PS250
INVASIVE SPECIES LABEL	I.S. I, I.S. II
INVASIVE SPECIES	INV

FLOODPLAIN / FLOODWAY

500 YEAR FLOODPLAIN BOUNDARY	FP500
100 YEAR FLOODPLAIN BOUNDARY	FP100
FLOODWAY	FW

ENGINEERING

CONSTRUCTION BASELINE — 30, 31, 32

PC, PT, POT (ON CONST BASELINE)

PI (IN CONSTRUCTION BASELINES)

INTERSECTION OR EQUATION OF TWO LINES

ORIGINAL GROUND LINE (PROFILES AND CROSS-SECTIONS)

PROFILE GRADE LINE (PROFILES AND CROSS-SECTIONS)

CLEARING LINE

SLOPE LINE

SLOPE LINE — CLEARING LINE

SLOPE LINE (FILL)

SLOPE LINE (CUT)

PROFILES AND CROSS SECTIONS:

ORIGINAL GROUND ELEVATION (LEFT) — 72.5

FINISHED GRADE ELEVATION (RIGHT) — 79.14

SHEET 1 OF 2

PLANS SUBJECT TO CHANGE DATE PLOTTED 11/14/2019

PAPER MYLAR SUBMISSION AUGUST 16, 2019

REVISION DATE	STATE OF NEW HAMPSHIRE			
11-21-2014	DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN			
Hoyle, Tanner & Associates, Inc.	*STANDARD SYMBOLS*			

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	SYM01	15879ISS	15879	2	12

DRAINAGE

- MANHOLE
- CATCH BASIN — cb (existing) / (PROPOSED)
- DROP INLET — di
- DRAINAGE PIPE (existing) — (label size & type)
- DRAINAGE PIPE (PROPOSED)
- UNDERDRAIN (existing) W/ FLUSHING BASIN — fb — show direction of flow — (label size & type)
- UNDERDRAIN (PROPOSED) W/ FLUSHING BASIN
- HEADER (existing & PROPOSED) — (with stone outlet protection)
- END SECTION (existing & PROPOSED) — METAL or PLASTIC; RCP
- OPEN DITCH (PROPOSED)
- EROSION CONTROL/ STONE SLOPE PROTECTION

BOUNDARIES / RIGHT-OF-WAY

- RIGHT-OF-WAY LINE — (label type)
- RR RIGHT-OF-WAY LINE
- PROPERTY LINE — P P
- PROPERTY LINE (COMMON OWNER) — Z Z
- TOWN LINE — BOW / CONCORD
- COUNTY LINE — COOS / GRAFTON
- STATE LINE — MAINE / NEW HAMPSHIRE
- NATIONAL FOREST
- CONSERVATION LAND — LC LC
- BENCH MARK / SURVEY DISK
- BOUND — bnd — (PROPOSED)
- STATE LINE/ TOWN LINE MONUMENT — S/L — T/L
- NHDOT PROJECT MARKER
- IRON PIPE OR PIN — ip
- DRILL HOLE IN ROCK — dh
- TAX MAP AND LOT NUMBER — 156 14 — 1642/341 — 6.80 Ac.±
- PROPERTY PARCEL NUMBER — 12
- HISTORIC PROPERTY — H

UTILITIES

existing — PROPOSED

- TELEPHONE POLE
- POWER POLE
- JOINT OCCUPANCY — (plot point at face not center of symbol)
- MISCELLANEOUS/UNKNOWN POLE
- GUY POLE OR PUSH BRACE
- LIGHT POLE
- LIGHT ON POWER POLE
- LIGHT ON JOINT POLE
- POLE STATUS: REMOVE, LEAVE, PROPOSED, OR TEMPORARY AS APPLICABLE e.g.: — R — L — P+04 25.0' — T+04 25.0'
- RAILROAD — (label ownership)
- RAILROAD SIGN
- RAILROAD SIGNAL
- UTILITY JUNCTION BOX — jb — JB
- OVERHEAD WIRE — OW OW (label type) — OW OW

UNDERGROUND UTILITIES

- WATER (on existing lines label size, type and note if abandoned) — W W — PW PW
- SEWER — S S — PS PS
- TELEPHONE — T T — PT PT
- ELECTRIC — E E — PE PE
- GAS — G G — PG PG
- LIGHTING — L L — PL PL
- INTELLIGENT TRANSPORTATION SYSTEM — ITS ITS — PITS PITS
- FIBER OPTIC — FO FO — PFO PFO
- WATER SHUT OFF — WSO
- GAS SHUT OFF — GSO
- HYDRANT — hyd — HYD

MANHOLES

- SEWER — MHS
- TELEPHONE — MHT
- ELECTRICAL — MHE
- GAS — MHG
- UNKNOWN

PLANS SUBJECT TO CHANGE
DATE PLOTTED
11/14/2019

PAPER MYLAR SUBMISSION AUGUST 16, 2019

TRAFFIC SIGNALS / ITS

existing — PROPOSED

- MAST ARM (existing) — 30' MA (NOTE ANGLE FROM ℄)
- OPTICOM RECEIVER
- OPTICOM STROBE
- TRAFFIC SIGNAL
- PEDESTAL WITH PEDESTRIAN SIGNAL HEADS AND PUSH BUTTON UNIT
- SIGNAL CONDUIT — C C C — PC PC PC
- CONTROLLER CABINET — cc — CC
- METER PEDESTAL — mp — MP
- PULL BOX — pb — PB
- LOOP DETECTOR (QUADRUPOLE) — (label size)
- LOOP DETECTOR (RECTANGULAR) — (label size)
- CAMERA POLE (CCTV)
- FIBER OPTIC DELINEATOR — fod — FOD
- FIBER OPTIC SPLICE VAULT — SVF
- ITS EQUIPMENT CABINET — its — ITS
- VARIABLE SPEED LIMIT SIGN
- DYNAMIC MESSAGE SIGN
- ROAD AND WEATHER INFO SYSTEM

CONSTRUCTION NOTES

CURB MARK NUMBER - BITUMINOUS	B-1
CURB MARK NUMBER - GRANITE	G-1
CLEARING AND GRUBBING AREA	A
DRAINAGE NOTE	1
EROSION CONTROL NOTE	A
FENCING NOTE	A
GUARDRAIL NOTE	1
ITS NOTE	1
LIGHTING NOTE	A
TRAFFIC SIGNAL NOTE	1

SHEET 2 OF 2

REVISION DATE	STATE OF NEW HAMPSHIRE			
9-1-2016	DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN			
Hoyle, Tanner & Associates, Inc.	STANDARD SYMBOLS			

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	SYM02	15879ISS	15879	3	12

EROSION CONTROL STRATEGIES

1. ENVIRONMENTAL COMMITMENTS:
   1.1. THESE GUIDELINES DO NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH ANY CONTRACT PROVISIONS, OR APPLICABLE FEDERAL, STATE, AND LOCAL REGULATIONS.
   1.2. THIS PROJECT WILL BE SUBJECT TO THE US EPA'S NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) STORM WATER CONSTRUCTION GENERAL PERMIT AS ADMINISTERED BY THE ENVIRONMENTAL PROTECTION AGENCY (EPA). THIS PROJECT IS SUBJECT TO REQUIREMENTS IN THE MOST RECENT CONSTRUCTION GENERAL PERMIT (CGP).
   1.3. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE NHDES WETLAND PERMIT, THE US ARMY CORPS OF ENGINEERS PERMIT, WATER QUALITY CERTIFICATION AND THE SPECIAL ATTENTION ITEMS INCLUDED IN THE CONTRACT DOCUMENTS.
   1.4. ALL STORM WATER, EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE NEW HAMPSHIRE STORMWATER MANUAL, VOLUME 3, EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION (DECEMBER 2008) (BMP MANUAL) AVAILABLE FROM THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES (NHDES).
   1.5. THE CONTRACTOR SHALL COMPLY WITH RSA 485-A:17, AND ALL, PUBLISHED NHDES ALTERATION OF TERRAIN ENV-WQ 1500 REQUIREMENTS (HTTP://DES.NH.GOV/ORGANIZATION/COMMISSIONER/LEGAL/RULES/INDEX.HTM)
   1.6. THE CONTRACTOR IS DIRECTED TO REVIEW AND COMPLY WITH SECTION 107.1 OF THE CONTRACT AS IT REFERS TO SPILLAGE, AND ALSO WITH REGARDS TO EROSION, POLLUTION, AND TURBIDITY PRECAUTIONS.

2. STANDARD EROSION CONTROL SEQUENCING APPLICABLE TO ALL CONSTRUCTION PROJECTS:
   2.1. PERIMETER CONTROLS SHALL BE INSTALLED PRIOR TO EARTH DISTURBING ACTIVITIES. PERIMETER CONTROLS AND STABILIZED CONSTRUCTION EXITS SHALL BE INSTALLED AS SHOWN IN THE BMP MANUAL AND AS DIRECTED BY THE STORMWATER POLLUTION PREVENTION PLAN (SWPPP) PREPARER.
   2.2. EROSION, SEDIMENTATION CONTROL MEASURES AND INFILTRATION BASINS SHALL BE CLEANED, REPLACED AND AUGMENTED AS NECESSARY TO PREVENT SEDIMENTATION BEYOND PROJECT LIMITS THROUGHOUT THE PROJECT DURATION.
   2.3. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSPECTED IN ACCORDANCE WITH THE CONSTRUCTION GENERAL PERMIT AND SECTION 645 OF THE NHDOT SPECIFICATIONS FOR ROAD AND BRIDGES CONSTRUCTION.
   2.4. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURRED:
      (A) BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED;
      (B) A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED;
      (C) A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIP-RAP HAS BEEN INSTALLED;
      (D) TEMPORARY SLOPE STABILIZATION CONFORMING TO TABLE 1 HAS BEEN PROPERLY INSTALLED
   2.5. ALL STOCKPILES SHALL BE CONTAINED WITH A PERIMETER CONTROL. IF THE STOCKPILE IS TO REMAIN UNDISTURBED FOR MORE THAN 14 DAYS, MULCHING WILL BE REQUIRED.
   2.6. A WATER TRUCK SHALL BE AVAILABLE TO CONTROL EXCESSIVE DUST AT THE DIRECTION OF THE CONTRACT ADMINISTRATOR.
   2.7. TEMPORARY EROSION AND SEDIMENTATION CONTROL MEASURES SHALL REMAIN UNTIL THE AREA HAS BEEN PERMANENTLY STABILIZED.
   2.8. CONSTRUCTION PERFORMED ANY TIME BETWEEN NOVEMBER 30" AND MAY 1" OF ANY YEAR SHALL BE CONSIDERED WINTER CONSTRUCTION AND SHALL CONFORM TO THE FOLLOWING REQUIREMENTS.
      (A) ALL PROPOSED VEGETATED AREAS WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15", OR WHICH ARE DISTURBED AFTER OCTOBER 15", SHALL BE STABILIZED IN ACCORDANCE WITH TABLE 1.
      (B) ALL DITCHES OR SWALES WHICH DO NOT EXHIBIT A MINIMUM OF 85% VEGETATIVE GROWTH BY OCTOBER 15", OR WHICH ARE DISTURBED AFTER OCTOBER 15", SHALL BE STABILIZED TEMPORARILY WITH STONE OR IN ACCORDANCE WITH TABLE 1.
      (C) AFTER NOVEMBER 30" INCOMPLETE ROAD SURFACES, WHERE WORK HAS STOPPED FOR THE SEASON, SHALL BE PROTECTED IN ACCORDANCE WITH TABLE 1.
      (D) WINTER EXCAVATION AND EARTHWORK SHALL BE DONE SUCH THAT NO MORE THAN 1 ACRE OF THE PROJECT IS WITHOUT STABILIZATION AT ONE TIME, UNLESS A WINTER CONSTRUCTION PLAN HAS BEEN APPROVED BY NHDOT THAT MEETS THE REQUIREMENTS OF ENV-WQ 1505.02 AND ENV-WQ 1505.05.
      (E) A SWPPP AMENDMENT SHALL BE SUBMITTED TO THE DEPARTMENT, FOR APPROVAL, ADDRESSING COLD WEATHER STABILIZATION (ENV-WQ 1505.05) AND INCLUDING THE REQUIREMENTS OF NO LESS THAN 30 DAYS PRIOR TO THE COMMENCEMENT OF WORK SCHEDULED AFTER NOVEMBER 30".

GENERAL CONSTRUCTION PLANNING AND SELECTION OF STRATEGIES TO CONTROL EROSION AND SEDIMENT ON HIGHWAY CONSTRUCTION PROJECTS

3. PLAN ACTIVITIES TO ACCOUNT FOR SENSITIVE SITE CONDITIONS:
   3.1. CLEARLY FLAG AREAS TO BE PROTECTED IN THE FIELD AND PROVIDE CONSTRUCTION BARRIERS TO PREVENT TRAFFICKING OUTSIDE OF WORK AREAS.
   3.2. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS.
   3.3. PROTECT AND MAXIMIZE EXISTING NATIVE VEGETATION AND NATURAL FOREST BUFFERS BETWEEN CONSTRUCTION ACTIVITY AND SENSITIVE AREAS.
   3.4. WHEN WORK IS PERFORMED IN AND NEAR WATER COURSES, STREAM FLOW DIVERSION METHODS SHALL BE IMPLEMENTED PRIOR TO ANY EXCAVATION OR FILLING.
   3.5. WHEN WORK IS PERFORMED WITHIN 50 FEET OF SURFACE WATERS (WETLAND, OPEN WATER OR FLOWING WATER), PERIMETER CONTROL SHALL BE ENHANCED CONSISTENT WITH SECTION 2.1.2.1. OF THE 2012 NPDES CONSTRUCTION GENERAL PERMIT.

4. MINIMIZE THE AMOUNT OF EXPOSED SOIL:
   4.1. CONSTRUCTION SHALL BE SEQUENCED TO LIMIT THE DURATION AND AREA OF EXPOSED SOILS. MINIMIZE THE AREA OF EXPOSED SOIL AT ANY ONE TIME. PHASING SHALL BE USED TO REDUCE THE AMOUNT AND DURATION OF SOIL EXPOSED TO THE ELEMENTS AND VEHICLE TRACKING.
   4.2. UTILIZE TEMPORARY MULCHING OR PROVIDE ALTERNATE TEMPORARY STABILIZATION ON EXPOSED SOILS IN ACCORDANCE WITH TABLE 1.
   4.3. THE MAXIMUM AMOUNT OF DISTURBED EARTH SHALL NOT EXCEED A TOTAL OF 5 ACRES FROM MAY 1" THROUGH NOVEMBER 30", OR EXCEED ONE ACRE DURING WINTER MONTHS, UNLESS THE CONTRACTOR DEMONSTRATES TO THE DEPARTMENT THAT THE ADDITIONAL AREA OF DISTURBANCE IS NECESSARY TO MEET THE CONTRACTORS CRITICAL PATH METHOD SCHEDULE (CPM), AND THE CONTRACTOR HAS ADEQUATE RESOURCES AVAILABLE TO ENSURE THAT ENVIRONMENTAL COMMITMENTS WILL BE MET.

5. CONTROL STORMWATER FLOWING ONTO AND THROUGH THE PROJECT:
   5.1. DIVERT OFF SITE RUNOFF OR CLEAN WATER AWAY FROM THE CONSTRUCTION ACTIVITY TO REDUCE THE VOLUME THAT NEEDS TO BE TREATED ON SITE.
   5.2. DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM DISTURBED AREAS, SLOPES, AND AROUND ACTIVE WORK AREAS AND TO A STABILIZED OUTLET LOCATION.
   5.3. CONSTRUCT IMPERMEABLE BARRIERS AS NECESSARY TO COLLECT OR DIVERT CONCENTRATED FLOWS FROM WORK OR DISTURBED AREAS.
   5.4. STABILIZE, TO APPROPRIATE ANTICIPATED VELOCITIES, CONVEYANCE CHANNELS OR PUMPING SYSTEMS NEEDED TO CONVEY CONSTRUCTION STORMWATER TO BASINS AND DISCHARGE LOCATIONS PRIOR TO USE.
   5.5. DIVERT OFF-SITE WATER THROUGH THE PROJECT IN AN APPROPRIATE MANNER SO NOT TO DISTURB THE UPSTREAM OR DOWNSTREAM SOILS, VEGETATION OR HYDROLOGY BEYOND THE PERMITTED AREA.

6. PROTECT SLOPES:
   6.1. INTERCEPT AND DIVERT STORM RUNOFF FROM UPSLOPE DRAINAGE AREAS AWAY FROM UNPROTECTED AND NEWLY ESTABLISHED AREAS AND SLOPES TO A STABILIZED OUTLET OR CONVEYANCE.
   6.2. CONSIDER HOW GROUNDWATER SEEPAGE ON CUT SLOPES MAY IMPACT SLOPE STABILITY AND INCORPORATE APPROPRIATE MEASURES TO MINIMIZE EROSION.
   6.3. CONVEY STORMWATER DOWN THE SLOPE IN A STABILIZED CHANNEL OR SLOPE DRAIN.
   6.4. THE OUTER FACE OF THE FILL SLOPE SHOULD BE IN A LOOSE RUFFLED CONDITION PRIOR TO TURF ESTABLISHMENT. TOPSOIL OR HUMUS LAYERS SHALL BE TRACKED UP AND DOWN THE SLOPE, DISKED, HARROWED, DRAGGED WITH A CHAIN OR MAT, MACHINE-RAKED, OR HAND-WORKED TO PRODUCE A RUFFLED SURFACE.

7. ESTABLISH STABILIZED CONSTRUCTION EXITS:
   7.1. INSTALL AND MAINTAIN CONSTRUCTION EXITS, ANYWHERE TRAFFIC LEAVES A CONSTRUCTION SITE ONTO A PUBLIC RIGHT-OF-WAY.
   7.2. SWEEP ALL CONSTRUCTION RELATED DEBRIS AND SOIL FROM THE ADJACENT PAVED ROADWAYS AS NECESSARY.

8. PROTECT STORM DRAIN INLETS:
   8.1. DIVERT SEDIMENT LADEN WATER AWAY FROM INLET STRUCTURES TO THE EXTENT POSSIBLE.
   8.2. INSTALL SEDIMENT BARRIERS AND SEDIMENT TRAPS AT INLETS TO PREVENT SEDIMENT FROM ENTERING THE DRAINAGE SYSTEM.
   8.3. CLEAN CATCH BASINS, DRAINAGE PIPES, AND CULVERTS IF SIGNIFICANT SEDIMENT IS DEPOSITED.
   8.4. DROP INLET SEDIMENT BARRIERS SHOULD NEVER BE USED AS THE PRIMARY MEANS OF SEDIMENT CONTROL AND SHOULD ONLY BE USED TO PROVIDE AN ADDITIONAL LEVEL OF PROTECTION TO STRUCTURES AND DOWN-GRADIENT SENSITIVE RECEPTORS.

9. SOIL STABILIZATION:
   9.1. WITHIN THREE DAYS OF THE LAST ACTIVITY IN AN AREA, ALL EXPOSED SOIL AREAS, WHERE CONSTRUCTION ACTIVITIES ARE COMPLETE, SHALL BE STABILIZED.
   9.2. IN ALL AREAS, TEMPORARY SOIL STABILIZATION MEASURES SHALL BE APPLIED IN ACCORDANCE WITH THE STABILIZATION REQUIREMENTS (SECTION 2.2) OF THE 2012 CGP. (SEE TABLE 1 FOR GUIDANCE ON THE SELECTION OF TEMPORARY SOIL STABILIZATION MEASURES.)
   9.3. EROSION CONTROL SEED MIX SHALL BE SOWN IN ALL INACTIVE CONSTRUCTION AREAS THAT WILL NOT BE PERMANENTLY SEEDED WITHIN TWO WEEKS OF DISTURBANCE AND PRIOR TO SEPTEMBER 15, OF ANY GIVEN YEAR, IN ORDER TO ACHIEVE VEGETATIVE STABILIZATION PRIOR TO THE END OF THE GROWING SEASON.
   9.4. SOIL TACKIFIERS MAY BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS AND REAPPLIED AS NECESSARY TO MINIMIZE SOIL AND MULCH LOSS UNTIL PERMANENT VEGETATION IS ESTABLISHED.

10. RETAIN SEDIMENT ON-SITE AND CONTROL DEWATERING PRACTICES:
   10.1. TEMPORARY SEDIMENT BASINS (CGP-SECTION 2.1.3.2) OR SEDIMENT TRAPS (ENV-WQ 1506.10) SHALL BE SIZED TO RETAIN, ON SITE, THE VOLUME OF A 2-YEAR 24-HOUR STORM EVENT FOR ANY AREA OF DISTURBANCE OR 3,600 CUBIC FEET OF STORMWATER RUNOFF PER ACRE OF DISTURBANCE, WHICHEVER IS GREATER. TEMPORARY SEDIMENT BASINS USED TO TREAT STORMWATER RUNOFF FROM AREAS GREATER THAN 5-ACRES OF DISTURBANCE SHALL BE SIZED TO ALSO CONTROL STORMWATER RUNOFF FROM A 10-YEAR 24 HOUR STORM EVENT. ON-SITE RETENTION OF THE 10-YEAR 24-HOUR EVENT IS NOT REQUIRED.
   10.2. CONSTRUCT AND STABILIZE DEWATERING INFILTRATION BASINS PRIOR TO ANY EXCAVATION THAT MAY REQUIRE DEWATERING.
   10.3. TEMPORARY SEDIMENT BASINS OR TRAPS SHALL BE PLACED AND STABILIZED AT LOCATIONS WHERE CONCENTRATED FLOW (CHANNELS AND PIPES) DISCHARGE TO THE SURROUNDING ENVIRONMENT FROM AREAS OF UNSTABILIZED EARTH DISTURBING ACTIVITIES.

11. ADDITIONAL EROSION AND SEDIMENT CONTROL GENERAL PRACTICES:
   11.1. USE TEMPORARY MULCHING, PERMANENT MULCHING, TEMPORARY VEGETATIVE COVER, AND PERMANENT VEGETATIVE COVER TO REDUCE THE NEED FOR DUST CONTROL. USE MECHANICAL SWEEPERS ON PAVED SURFACES WHERE NECESSARY TO PREVENT DUST BUILDUP. APPLY WATER, OR OTHER DUST INHIBITING AGENTS OR TACKIFIERS, AS APPROVED BY THE NHDES.
   11.2. ALL STOCKPILES SHALL BE CONTAINED WITH TEMPORARY PERIMETER CONTROLS. INACTIVE SOIL STOCKPILES SHOULD BE PROTECTED WITH SOIL STABILIZATION MEASURES (TEMPORARY EROSION CONTROL SEED MIX AND MULCH, SOIL BINDER) OR COVERED WITH ANCHORED TARPS.
   11.3. EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSPECTED IN ACCORDANCE WITH SECTION 645 OF NHDOT SPECIFICATIONS, WEEKLY AND WITHIN 24 HOURS AFTER ANY STORM EVENT GREATER THAN 0.25 IN. OF RAIN PER 24-HOUR PERIOD. EROSION AND SEDIMENT CONTROL MEASURES WILL ALSO BE INSPECTED IN ACCORDANCE WITH THE GUIDANCE MEMO FROM THE NHDES CONTAINED WITHIN THE CONTRACT PROPOSAL AND THE EPA CONSTRUCTION GENERAL PERMIT.
   11.4. THE CONTRACTOR SHOULD UTILIZE STORM DRAIN INLET PROTECTION TO PREVENT SEDIMENT FROM ENTERING A STORM DRAINAGE SYSTEM PRIOR TO THE PERMANENT STABILIZATION OF THE CONTRIBUTING DISTURBED AREA.
   11.5. PERMANENT STABILIZATION MEASURES WILL BE CONSTRUCTED AND MAINTAINED IN LOCATIONS AS SHOWN ON THE CONSTRUCTION PLANS TO STABILIZE AREAS. VEGETATIVE STABILIZATION SHALL NOT BE CONSIDERED PERMANENTLY STABILIZED UNTIL VEGETATIVE GROWTH COVERS AT LEAST 85% OF THE DISTURBED AREA. THE CONTRACTOR SHALL BE RESPONSIBLE FOR EROSION AND SEDIMENT CONTROL FOR ONE YEAR AFTER PROJECT COMPLETION.
   11.6. CATCH BASINS: CARE SHALL BE TAKEN TO ENSURE THAT SEDIMENTS DO NOT ENTER ANY EXISTING CATCH BASINS DURING CONSTRUCTION. THE CONTRACTOR SHALL PLACE TEMPORARY STONE INLET PROTECTION OVER INLETS IN AREAS OF SOIL DISTURBANCE THAT ARE SUBJECT TO SEDIMENT CONTAMINATION.
   11.7. TEMPORARY AND PERMANENT DITCHES SHALL BE CONSTRUCTED, STABILIZED AND MAINTAINED IN A MANNER THAT WILL MINIMIZE SCOUR. TEMPORARY AND PERMANENT DITCHES SHALL BE DIRECTED TO DRAIN TO SEDIMENT BASINS OR STORM WATER COLLECTION AREAS.
   11.8. WINTER EXCAVATION AND EARTHWORK ACTIVITIES NEED TO BE LIMITED IN EXTENT AND DURATION, TO MINIMIZE POTENTIAL EROSION AND SEDIMENTATION IMPACTS. THE AREA OF EXPOSED SOIL SHALL BE LIMITED TO ONE ACRE, OR THAT WHICH CAN BE STABILIZED AT THE END OF EACH DAY UNLESS A WINTER CONSTRUCTION PLAN, DEVELOPED BY A QUALIFIED ENGINEER OR A CPESC SPECIALIST, IS REVIEWED AND APPROVED BY THE DEPARTMENT.
   11.9. CHANNEL PROTECTION MEASURES SHALL BE SUPPLEMENTED WITH PERIMETER CONTROL MEASURES WHEN THE DITCH LINES OCCUR AT THE BOTTOM OF LONG FILL SLOPES. THE PERIMETER CONTROLS SHALL BE INSTALLED ON THE FILL SLOPE TO MINIMIZE THE POTENTIAL FOR FILL SLOPE SEDIMENT DEPOSITS IN THE DITCH LINE.

BEST MANAGEMENT PRACTICES (BMP) BASED ON AMOUNT OF OPEN CONSTRUCTION AREA

12. STRATEGIES SPECIFIC TO OPEN AREAS LESS THAN 5 ACRES:
   12.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500; ALTERATION OF TERRAIN FOR CONSTRUCTION AND USE ALL CONVENTIONAL BMP STRATEGIES.
   12.2. SLOPES STEEPER THAN 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING.
   12.3. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT ALONE.
   12.4. AREAS WHERE HAUL ROADS ARE CONSTRUCTED AND STORMWATER CANNOT BE TREATED THE DEPARTMENT WILL CONSIDER INFILTRATION.
   12.5. FOR HAUL ROADS ADJACENT TO SENSITIVE ENVIRONMENTAL AREAS OR STEEPER THAN 5%, THE DEPARTMENT WILL CONSIDER USING EROSION STONE, CRUSHED GRAVEL, OR CRUSHED STONE BASE TO HELP MINIMIZE EROSION ISSUES.
   12.6. ALL AREAS THAT CAN BE STABILIZED SHALL BE STABILIZED PRIOR TO OPENING UP NEW TERRITORY.
   12.7. DETENTION BASINS SHALL BE DESIGNED AND CONSTRUCTED TO ACCOMMODATE A 2 YEAR STORM EVENT.

13. STRATEGIES SPECIFIC TO OPEN AREAS BETWEEN 5 AND 10 ACRES:
   13.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES WILL BE UTILIZED.
   13.2. DETENTION BASINS WILL BE CONSTRUCTED TO ACCOMMODATE THE 2-YEAR 24-HOUR STORM EVENT AND CONTROL A 10-YEAR 24-HOUR STORM EVENT.
   13.3. SLOPES STEEPER THAN A 3:1 WILL RECEIVE TURF ESTABLISHMENT WITH MATTING OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS. OTHER ALTERNATIVE MEASURES, SUCH AS BONDED FIBER MATRIXES (BFMS) OR FLEXIBLE GROWTH MEDIUMS (FGMS) MAY BE UTILIZED, IF MEETING THE NHDES APPROVALS AND REGULATIONS.
   13.4. SLOPES 3:1 OR FLATTER WILL RECEIVE TURF ESTABLISHMENT OR OTHER TEMPORARY SOIL STABILIZATION MEASURES DETAILED IN TABLE 1. THE CONTRACTOR MAY ALSO CONSIDER A SOIL BINDER IN ACCORDANCE WITH THE NHDES APPROVALS OR REGULATIONS.

14. STRATEGIES SPECIFIC TO OPEN AREAS OVER 10 ACRES:
   14.1. THE CONTRACTOR SHALL COMPLY WITH RSA 485:A:17 AND ENV-WQ 1500 ALTERATION OF TERRAIN AND SHALL USE CONVENTIONAL BMP STRATEGIES AND ALL TREATMENT OPTIONS USED FOR UNDER 5 ACRES AND BETWEEN 5 AND 10 ACRES WILL BE UTILIZED.
   14.2. THE DEPARTMENT ANTICIPATES THAT SOIL BINDERS WILL BE NEEDED ON ALL SLOPES STEEPER THAN 3:1, IN ORDER TO MINIMIZE EROSION AND REDUCE THE AMOUNT OF SEDIMENT IN THE STORMWATER TREATMENT BASINS.
   14.3. THE CONTRACTOR WILL BE REQUIRED TO HAVE AN APPROVED DESIGN IN ACCORDANCE WITH ENV-WQ 1506.12 FOR AN ACTIVE FLOCCULANT TREATMENT SYSTEM TO TREAT AND RELEASE WATER CAPTURED IN STORM WATER BASINS. THE CONTRACTOR SHALL ALSO RETAIN THE SERVICES OF AN ENVIRONMENTAL CONSULTANT WHO HAS DEMONSTRATED EXPERIENCE IN THE DESIGN OF FLOCCULANT TREATMENT SYSTEMS. THE CONSULTANT WILL ALSO BE RESPONSIBLE FOR THE IMPLEMENTATION AND MONITORING OF THE SYSTEM.

TABLE 1
GUIDANCE ON SELECTING TEMPORARY SOIL STABILIZATION MEASURES

APPLICATION AREAS	DRY MULCH METHODS				HYDRAULICALLY APPLIED MULCHES[2]				ROLLED EROSION CONTROL BLANKETS[3]			
	HMT	WC	SG	CB	HM	SMM	BFM	FRM	SNSB	DNSB	DNSCB	DNCB
SLOPES[1]												
STEEPER THAN 2:1	NO	NO	YES	NO	NO	NO	NO	YES	NO	NO	NO	YES
2:1 SLOPE	YES'	YES'	YES	YES	NO	NO	YES	YES	NO	YES	YES	YES
3:1 SLOPE	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	NO
4:1 SLOPE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO
WINTER STABILIZATION	4T/AC	YES	YES	YES	NO	NO	YES	YES	YES	YES	YES	YES
CHANNELS												
LOW FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
HIGH FLOW CHANNELS	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE	ABBREV.	STABILIZATION MEASURE
HMT	HAY MULCH & TACK	HM	HYDRAULIC MULCH	SNSB	SINGLE NET STRAW BLANKET
WC	WOOD CHIPS	SMM	STABILIZED MULCH MATRIX	DNSB	DOUBLE NET STRAW BLANKET
SG	STUMP GRINDINGS	BFM	BONDED FIBER MATRIX	DNSCB	2 NET STRAW-COCONUT BLANKET
CB	COMPOST BLANKET	FRM	FIBER REINFORCED MEDIUM	DNCB	2 NET COCONUT BLANKET

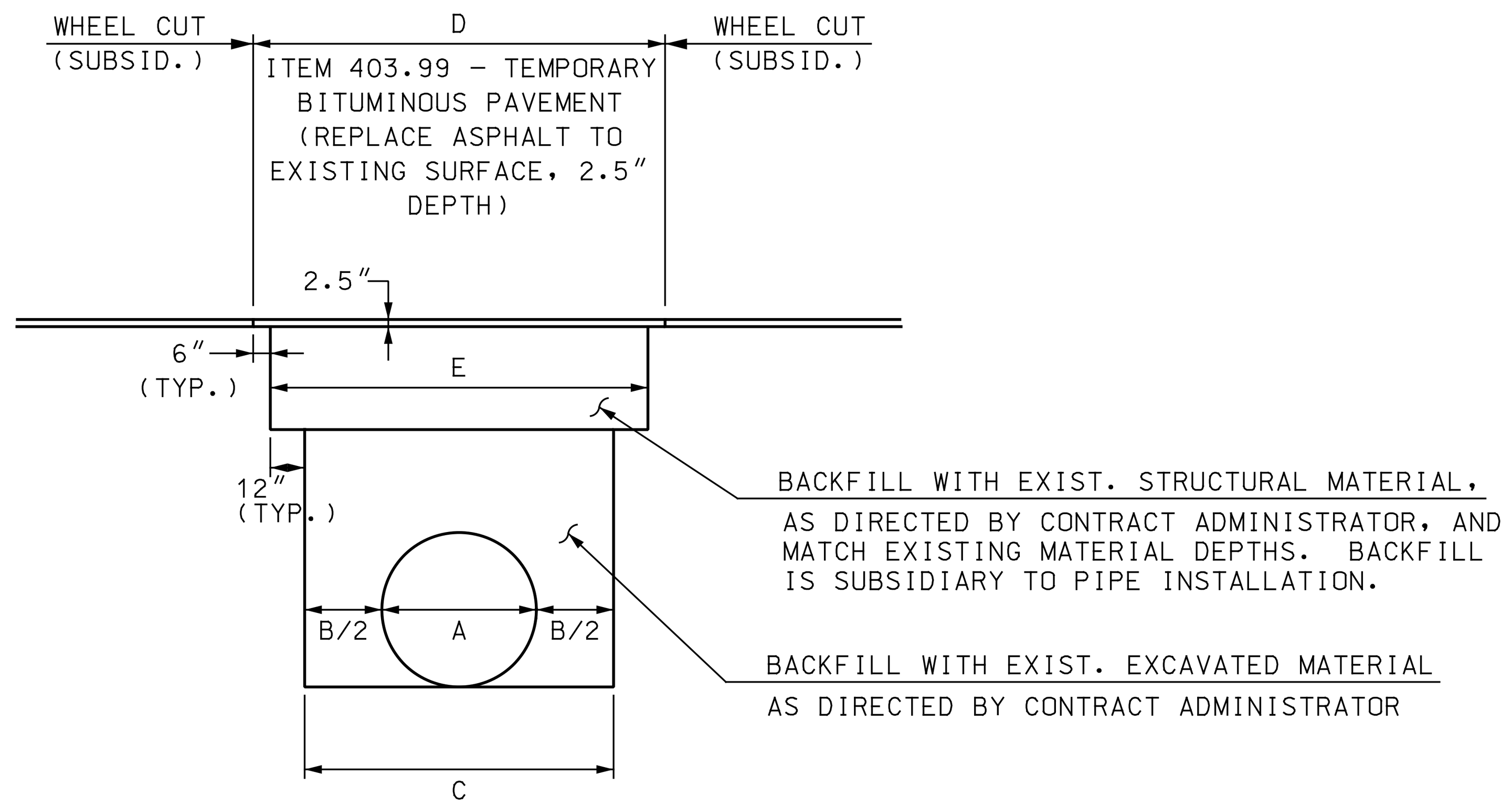
NOTES:
1. ALL SLOPE STABILIZATION OPTIONS ASSUME A SLOPE LENGTH ≤10 TIMES THE HORIZONTAL DISTANCE COMPONENT OF THE SLOPE, IN FEET.
2. PRODUCTS CONTAINING POLYACRYLAMIDE (PAM) SHALL NOT BE APPLIED DIRECTLY TO OR WITHIN 100 FEET OF ANY SURFACE WATER WITHOUT PRIOR WRITTEN APPROVAL FROM THE NH DEPARTMENT OF ENVIRONMENTAL SERVICES.
3. ALL EROSION CONTROL BLANKETS SHALL BE MADE WITH WILDLIFE FRIENDLY BIODEGRADABLE NETTING.

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL STRATEGIES AND STABILIZATION MATRIX

REVISION DATE	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
12-21-2015	15879eroplans	15879	4	12



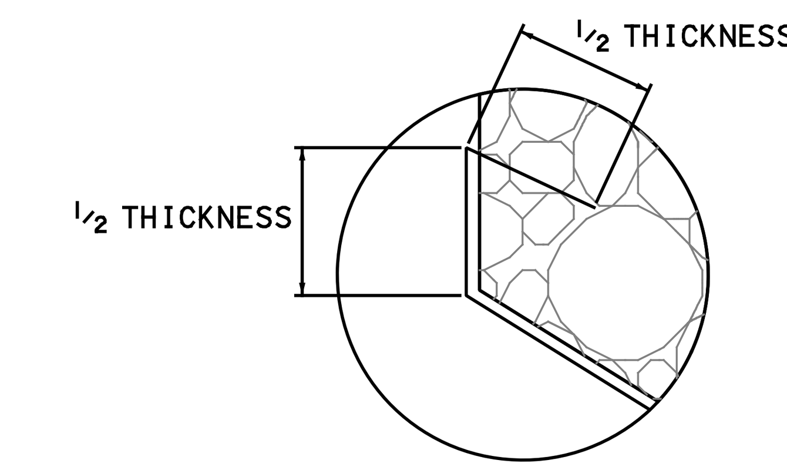
SAMPLE TRENCH DIMENSIONS
SEE DRAINAGE NOTES FOR ACTUAL PIPE DIMENSIONS

A PIPE DIA.	B ADDIT. WIDTH	C TRENCH WIDTH	D CUT WIDTH	E GRAVEL BOX WIDTH
6"	30"	36"	72"	60"
12"	24"	36"	72"	60"
15"	24"	39"	75"	63"
18"	24"	42"	78"	66"
24"	24"	48"	84"	72"
30"	30"	60"	96"	84"

NOTES:
1. SEE NHDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION SECTION 206 FOR TRENCH AND ADDITIONAL WIDTHS.
2. DIMENSION D IS THE PAY LIMITS FOR ITEM 403.99. COSTS FOR RESTORATION BEYOND THESE LIMITS WILL BE AT THE CONTRACTOR'S EXPENSE.
3. AS DIRECTED BY CONTRACT ADMINISTRATOR, UNSUITABLE BACKFILL MATERIAL WILL BE REPLACED WITH MATERIAL CONFORMING TO ITEM 209.1 - GRANULAR BACKFILL (SUBSID.).

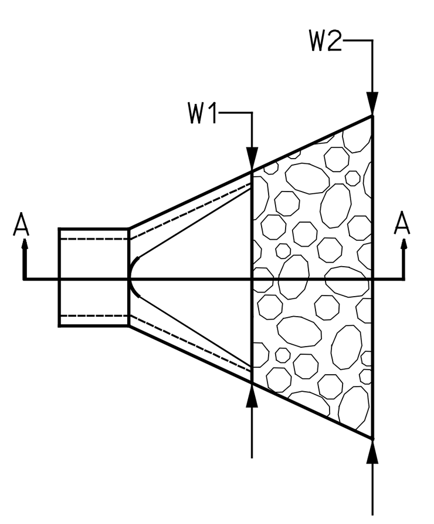
PAVEMENT TRENCH REPAIR

NOT TO SCALE

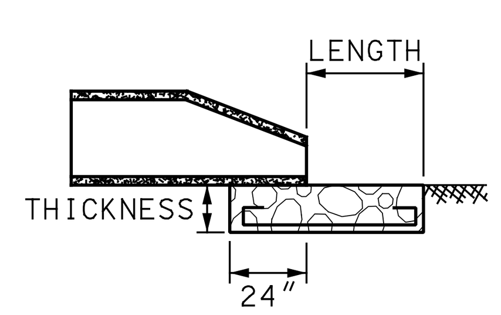


GEOTEXTILE DETAIL

NOT TO SCALE



PLAN

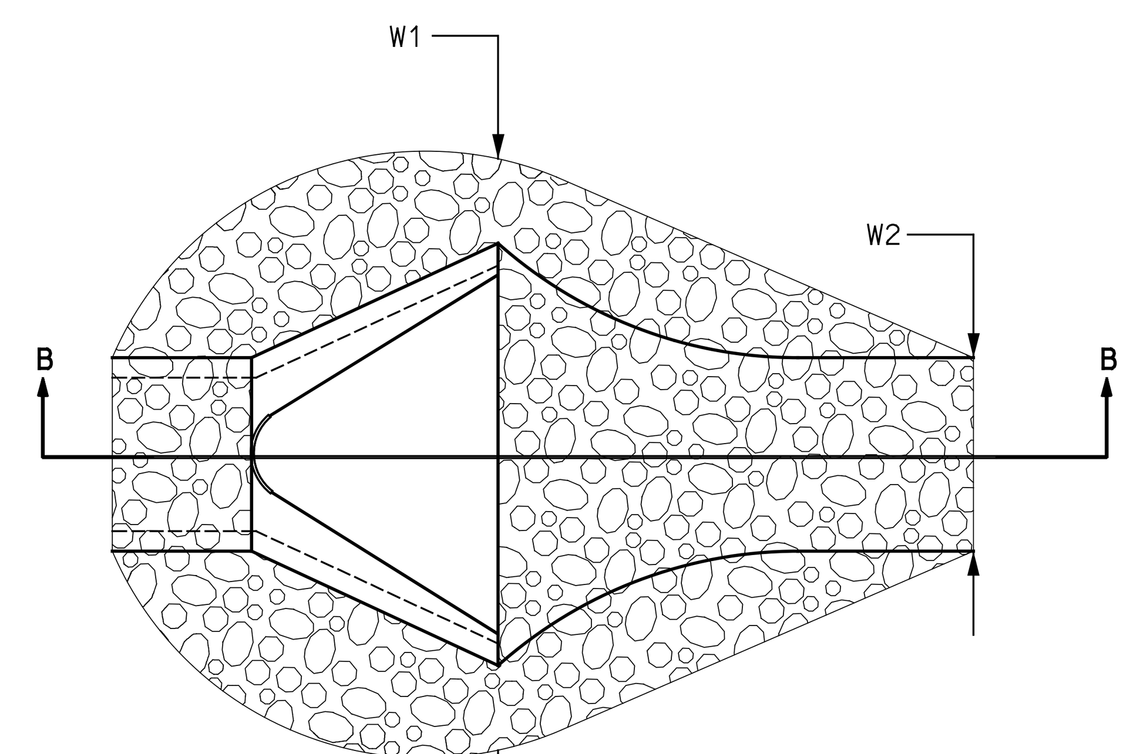


SECTION A-A

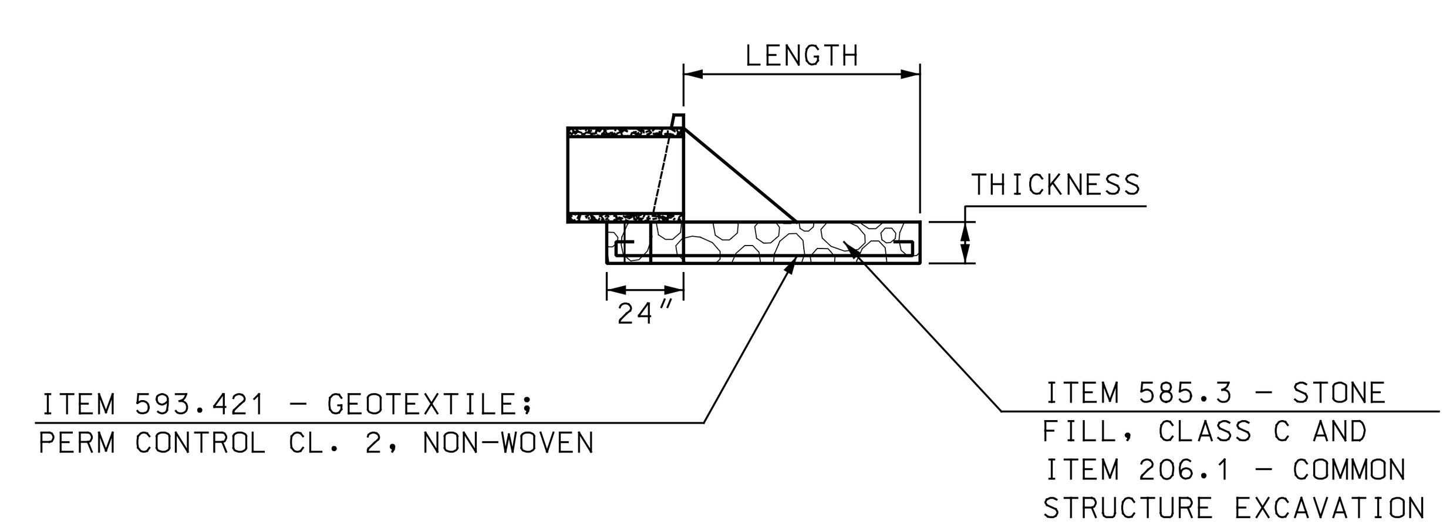
PIPE OUTLET TO FLAT AREA WITH NO DEFINED CHANNEL

NOT TO SCALE

NOTES:
1. ITEM 593.411 - GEOTEXTILE; PERM. CONTROL CL. 1, NON-WOVEN TO BE PLACED BETWEEN STONE FILL, CLASS B AND SOIL
2. ITEM 593.421 - GEOTEXTILE; PERM. CONTROL CL. 2, NON-WOVEN TO BE PLACED BETWEEN STONE FILL, CLASS C AND SOIL



PLAN



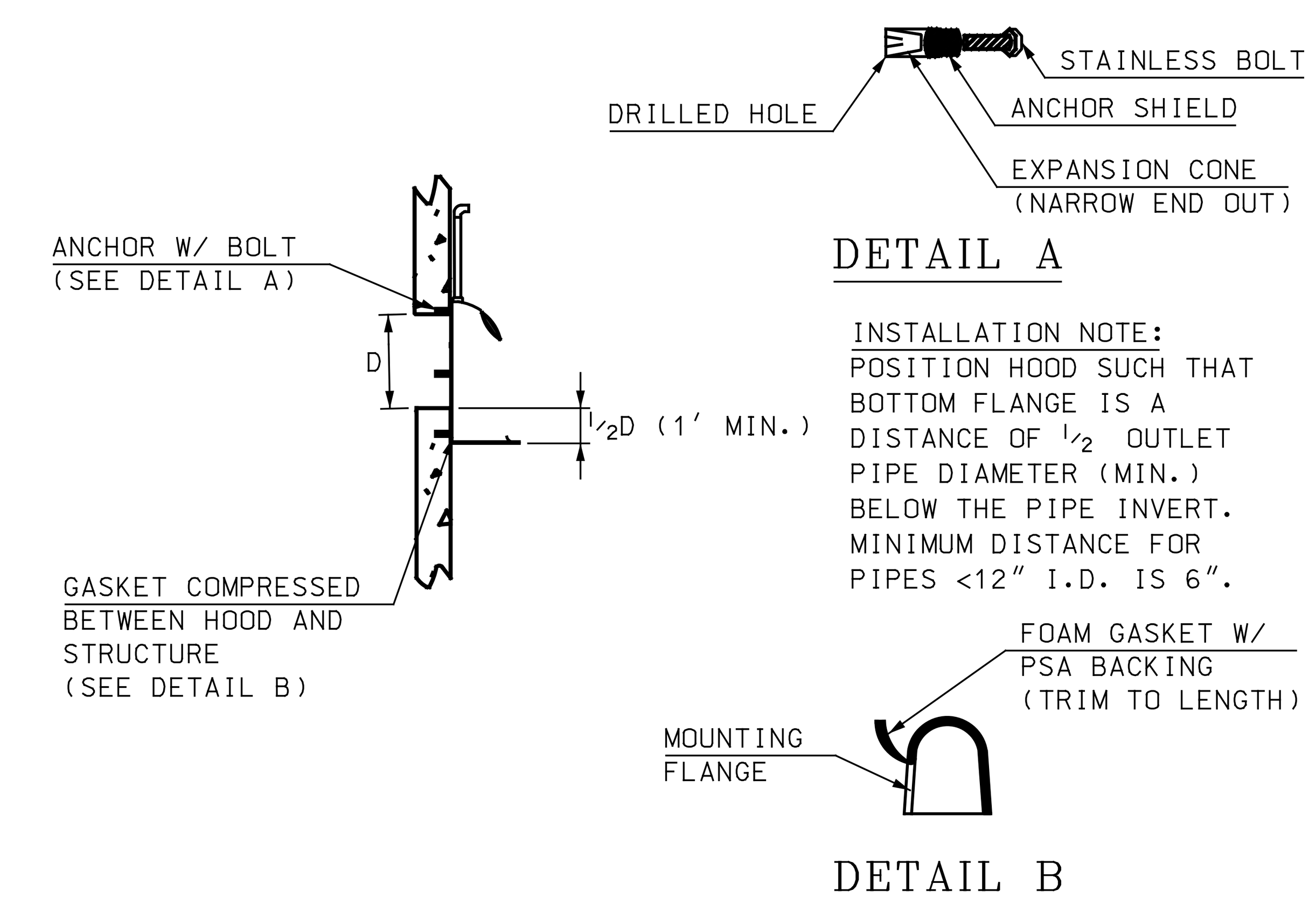
SECTION B-B

PIPE OUTLET TO WELL DEFINED CHANNEL

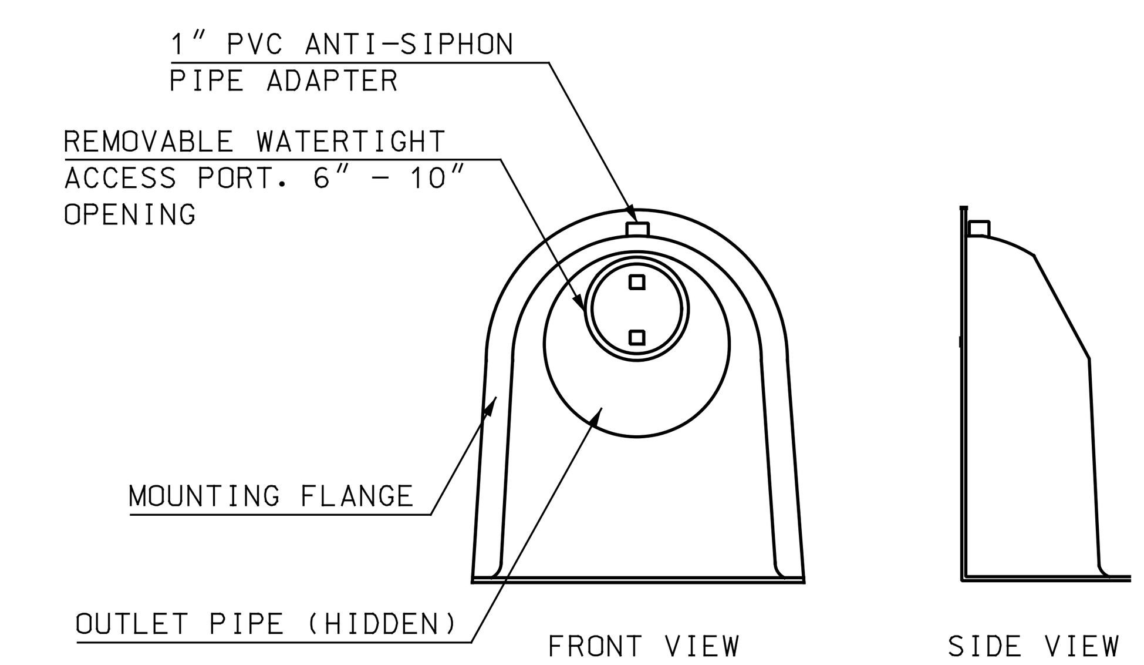
NOT TO SCALE

		OUTLET/INLET					
DRAIN NOTE #	OUTLET STATION	W_1 (ft)	W_2 (ft)	L_a (ft)	THICKNESS (ft)	STONE CLASS	VOLUME (CY)
1	244+25.00, RT. 39.05	7.5	7.5	15.4	1.00	CLASS C	4.3
9	248+00.00, RT. 37.30	3.8	7.8	10.1	2.00	CLASS B	SEE NOTE BELOW
10	249+25.00, RT. 40.00	3.8	8.3	11.2	2.00	CLASS B	SEE NOTE BELOW
12	301+06.10, LT. 52.60	4.5	9.0	16.2	1.00	CLASS C	4.1
15	301+00.80, RT. 96.00	4.5	10.1	13.0	1.00	CLASS C	3.5
Exist.	246+02.40, RT. 27.50	6.0	12.0	11.0	1.00	CLASS C	3.5

Note: Drain Notes 9 and 10 outlet onto the Class B, Stone Slope. No additional outlet protection will be provided.

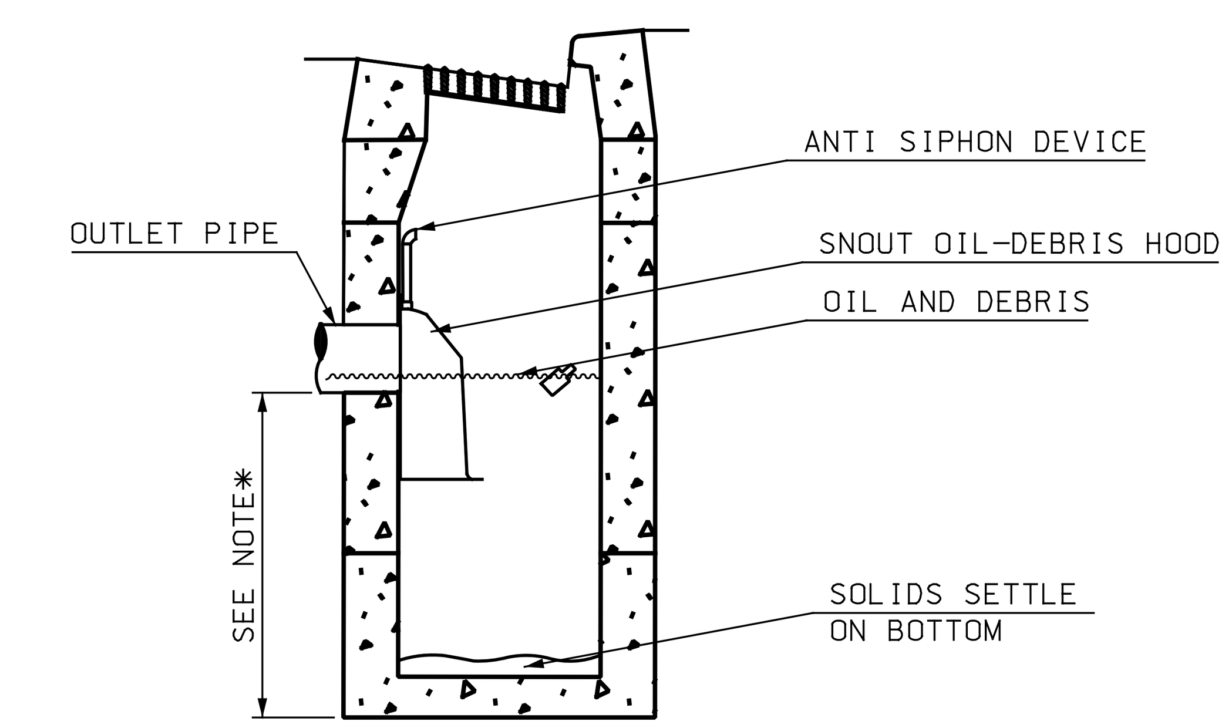


INSTALLATION DETAIL



CONFIGURATION DETAIL

NOTES:
1. ALL HOODS SHALL BE CONSTRUCTED OF A GLASS REINFORCED RESIN COMPOSITE WITH ISO GEL COAT EXTERIOR FINISH WITH A MINIMUM 0.125" LAMINATE THICKNESS.
2. ALL HOODS SHALL BE EQUIPPED WITH A WATERTIGHT ACCESS PORT, A MOUNTING FLANGE, AND AN ANTI-SIPHON VENT AND ELBOW AS DRAWN. (SEE CONFIGURATION DETAIL)
3. THE SIZE AND POSITION OF THE HOOD SHALL BE DETERMINED BY OUTLET PIPE SIZE AS PER MANUFACTURER'S RECOMMENDATION (SNOUT SIZE ALWAYS LARGER THAN PIPE SIZE).
4. THE BOTTOM OF THE HOOD SHALL EXTEND DOWNWARD A DISTANCE EQUAL TO 1/2 THE OUTLET PIPE DIAMETER WITH A MINIMUM DISTANCE OF 6" FOR PIPES <12" I.D.
5. THE ANTI-SIPHON VENT SHALL EXTEND ABOVE HOOD BY MINIMUM OF 3" AND A MAXIMUM OF 12" ACCORDING TO STRUCTURE CONFIGURATION.
6. THE SURFACE OF THE STRUCTURE WHERE THE HOOD IS MOUNTED SHALL BE FINISHED SMOOTH AND FREE OF LOOSE MATERIAL AND PIPE SHALL BE FINISHED FLUSH TO WALL.
7. ALL STRUCTURE JOINTS SHALL BE WATERTIGHT.
8. THE HOOD SHALL BE SECURELY ATTACHED TO STRUCTURE WALL WITH 3/8" STAINLESS STEEL BOLTS AND OIL-RESISTANT GASKET AS SUPPLIED BY MANUFACTURER. (SEE INSTALLATION DETAIL)



* NOTE- SUMP DEPTH OF 36" MIN. FOR <OR=12" DIAM. OUTLET. FOR OUTLETS >OR=15", DEPTH = 2.5 3X DIAM.

TYPICAL INSTALLATION

ITEM 604.0009 OIL-WATER SEPARATORS FOR CATCH BASINS

NOT TO SCALE

PLANS SUBJECT TO CHANGE DATE PLOTTED 11/14/2019

PAPER MYLAR SUBMISSION AUGUST 16, 2019

Hoyle, Tanner & Associates, Inc.

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

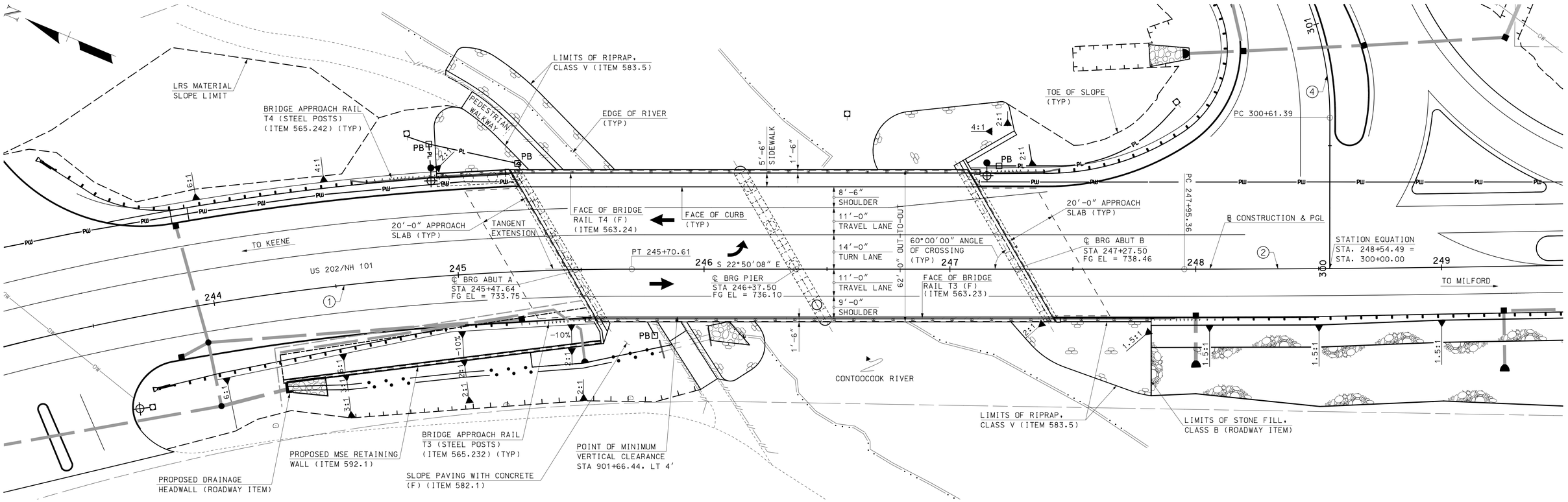
DRAINAGE DETAILS

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879DTL01	15879DTL00	15879	5	12

REVISIONS AFTER PROPOSAL

NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	NHDOT	DATE 1/13/12 - 8/13/12
NEW DESIGN	AGB	DATE 8/2019
SHEET CHECKED	TMC	DATE 8/2019
AS BUILT DETAILS		DATE



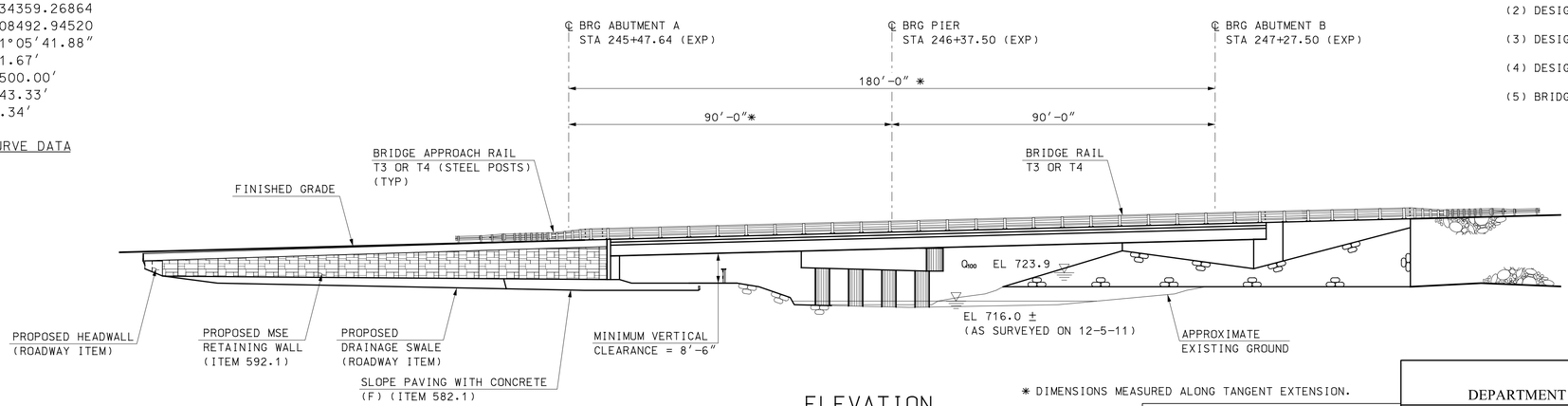
PLAN
SCALE: 1" = 20'-0"

NH ROUTE 101 CURVE DATA

CURVE No. ①	CURVE No. ②
PI = 242+91.90	PI = 248+67.03
N = 134902.74987	N = 134359.26864
E = 908264.08854	E = 908492.94520
Δ = 31°12'43.76"	Δ = 1°05'41.88"
T = 293.29'	T = 71.67'
R = 1050.00'	R = 7500.00'
L = 571.99'	L = 143.33'
E = 40.19'	E = 0.34'

US ROUTE 202 (GRANITE ST) CURVE DATA

CURVE No. ④
PI = 301+41.34
N = 134425.63130
E = 908618.61774
Δ = 63°11'10.09"
T = 79.95'
R = 130.00'
L = 143.36'
E = 22.62'



ELEVATION
SCALE: 1" = 20'-0"

✱ DIMENSIONS MEASURED ALONG TANGENT EXTENSION.

HYDRAULIC DATA

(1) DRAINAGE AREA: 72.1 SQUARE MILES
(2) DESIGN FLOOD: Q100 = 5700 CFS
(3) DESIGN VELOCITY: 10.1 FPS
(4) DESIGN FLOOD HEIGHT: 12.8 FEET OF WATER TO ELEVATION 723.9
(5) BRIDGE WATERWAY OPENING: 1128 SQ FT. BELOW Q100 ELEVATION

PAPER MYLAR BRIDGE PLANS
NOT FOR CONSTRUCTION
DATE: AUGUST 16, 2019

Hoyle, Tanner & Associates, Inc.

HTA PROJECT NO.	MODEL
092554	15879GenPlan

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
XX	15879Genplan	AS SHOWN

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

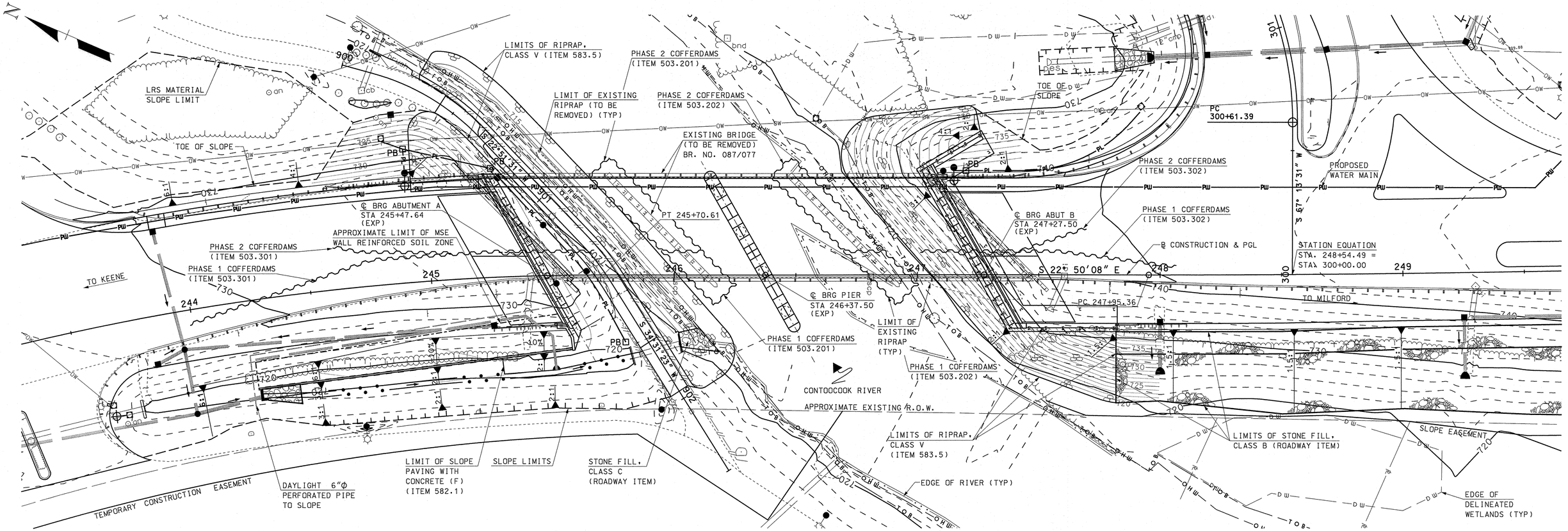
TOWN PETERBOROUGH BRIDGE NO. 086/076 STATE PROJECT 15879
LOCATION US RTE 202 & NH RTE 101 OVER THE CONTOOCOOK RIVER

GENERAL PLAN AND ELEVATION

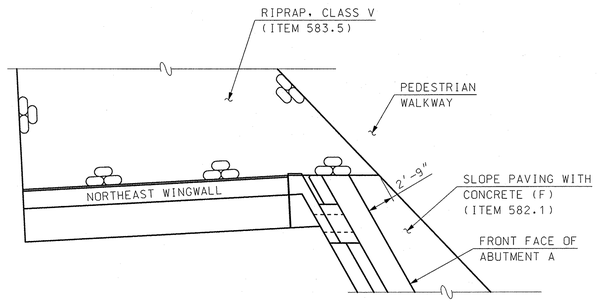
BRIDGE SHEET 6 OF 70
FILE NUMBER

REVISIONS AFTER PROPOSAL	BY	DATE		BY	DATE
DESIGNED	EGW	1/14	CHECKED	EGW	1/14
DRAWN	PBD	1/14	CHECKED	EGW	1/14
QUANTITIES	JCR	9/17	CHECKED	KMW	9/17

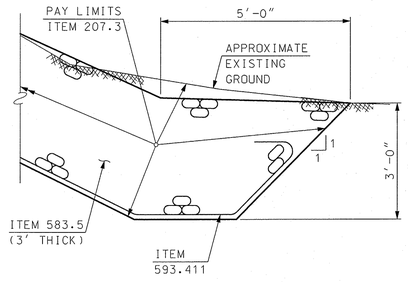
ISSUE DATE	FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE	X-A001(007)	6	12



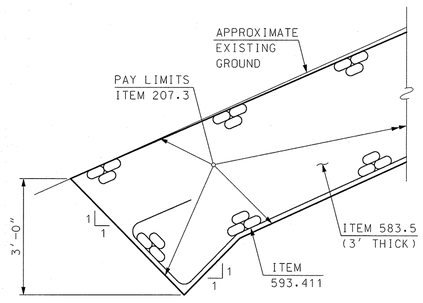
SITE PLAN
SCALE: 1" = 20'-0"



END SLOPE PAVING DETAIL
SCALE: 1/8" = 1'-0"



ABUTMENT A RIPRAP KEY DETAIL
SCALE: 1/2" = 1'-0"



ABUTMENT B RIPRAP KEY DETAIL
SCALE: 1/2" = 1'-0"

EDWARD G. WEINGARTNER No. 9140 LICENSED PROFESSIONAL ENGINEER STATE OF NEW HAMPSHIRE
11/14/18

Hoyle, Tanner & Associates, Inc.

HTA PROJECT NO.	MODEL
092554	15879Siteplan

SUBDIRECTORY	.DGN LOCATOR	SHEET SCALE
XX	15879SitePlan	AS SHOWN

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION * BUREAU OF BRIDGE DESIGN

TOWN PETERBOROUGH BRIDGE NO. 086/076 STATE PROJECT 15879

LOCATION US RTE 202 & NH RTE 101 OVER THE CONTOOCOOK RIVER

SITE PLAN

BRIDGE SHEET 7 OF 70

FILE NUMBER

REVISIONS AFTER PROPOSAL

	BY	DATE		BY	DATE
DESIGNED	EGW	1/14	CHECKED	EGW	1/14
DRAWN	PBD	1/14	CHECKED	EGW	1/14
QUANTITIES	JCR	9/17	CHECKED	KMW	9/17
ISSUE DATE			FEDERAL PROJECT NO.	SHEET NO.	TOTAL SHEETS
REV. DATE			X-A001(007)	7	12

WETLAND IMPACT SUMMARY

WETLAND NUMBER	WETLAND CLASS-IFICATION	LOCATION	AREA IMPACTS					
			PERMANENT				TEMPORARY	
			N.H.W.B. (NON-WETLAND)		N.H.W.B. & A.C.O.E. (WETLAND)			
			SF	LF	SF	LF	SF	LF
2	PUBHh	A			675	70		
2	PUBHh	B					3,935	57
3	BANK	C					1,197	194
4	PSS1Ud	D			15	13		
3	BANK	E	103	37				
5	R2UBH	F			64	18		
1	BANK	G	378	105				
6	BANK	H					82	49
5	R2UBH	I					9,146	123
3	BANK	J	64	26				
7	PSS1Ud	K					567	82
4	PSS1Ud	L					436	25
8	R45B6	M					27	16
9	PSS1C	N					346	29
1	BANK	O	236	68				
5	R2UBH	P			835	106		
7	PSS1Ud	Q					75	25
	TOTAL		781	236	1,589	207	15,811	600

NOTE:
1. BOUNDARY BETWEEN PUBHh AND R2UBH IS NORTHERN EDGE OF EXISTING BRIDGE DECK.
2. IMPACTS TO PUBHh ARE CONSIDERED IMPACTS TO THE RIVER CHANNEL FOR THE PURPOSE OF THIS PERMIT APPLICATIONS.

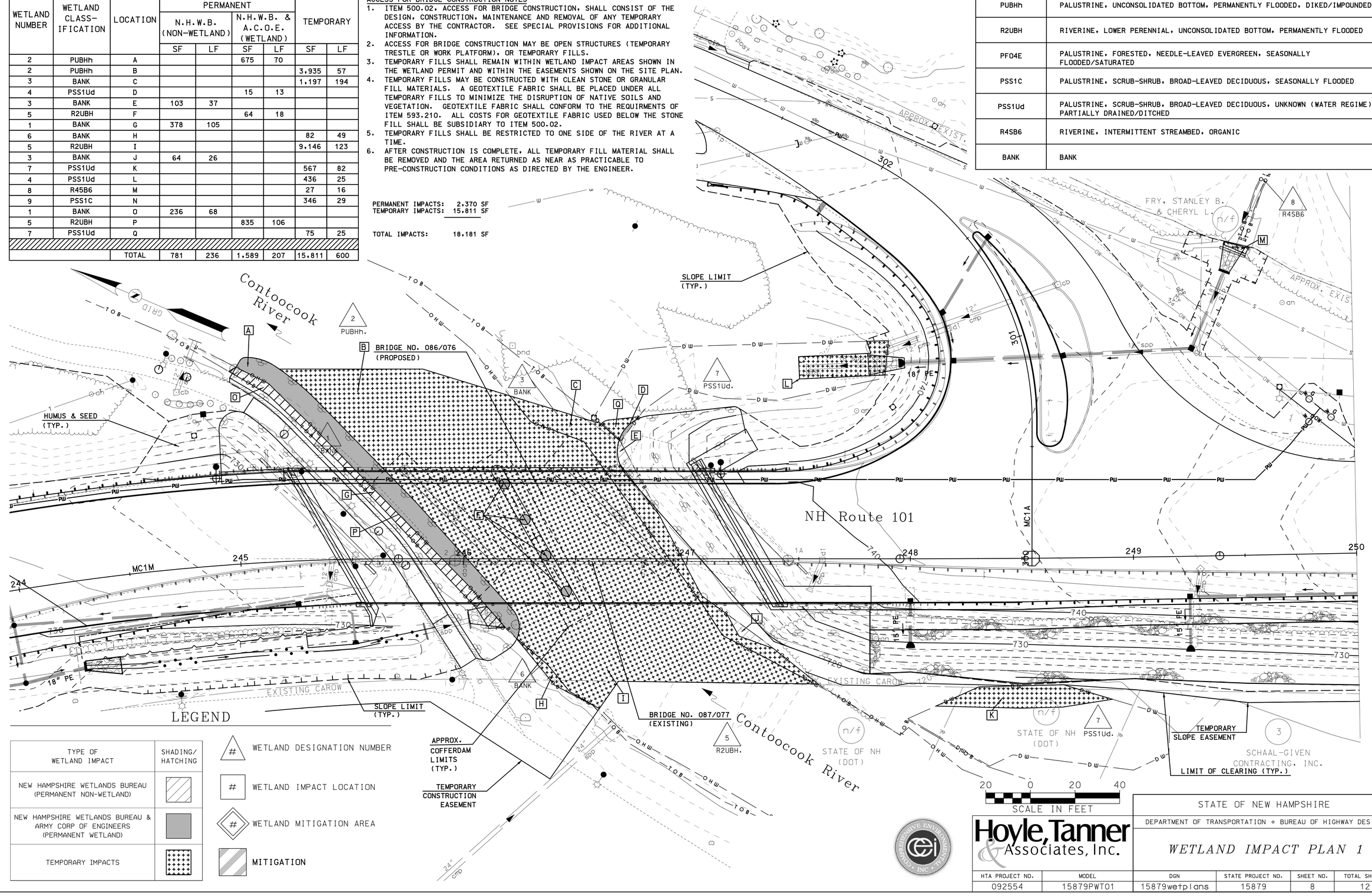
ACCESS FOR BRIDGE CONSTRUCTION NOTES
1. ITEM 500.02, ACCESS FOR BRIDGE CONSTRUCTION, SHALL CONSIST OF THE DESIGN, CONSTRUCTION, MAINTENANCE AND REMOVAL OF ANY TEMPORARY ACCESS BY THE CONTRACTOR. SEE SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION.
2. ACCESS FOR BRIDGE CONSTRUCTION MAY BE OPEN STRUCTURES (TEMPORARY TRESTLE OR WORK PLATFORM), OR TEMPORARY FILLS.
3. TEMPORARY FILLS SHALL REMAIN WITHIN WETLAND IMPACT AREAS SHOWN IN THE WETLAND PERMIT AND WITHIN THE EASEMENTS SHOWN ON THE SITE PLAN.
4. TEMPORARY FILLS MAY BE CONSTRUCTED WITH CLEAN STONE OR GRANULAR FILL MATERIALS. A GEOTEXTILE FABRIC SHALL BE PLACED UNDER ALL TEMPORARY FILLS TO MINIMIZE THE DISRUPTION OF NATIVE SOILS AND VEGETATION. GEOTEXTILE FABRIC SHALL CONFORM TO THE REQUIRMENTS OF ITEM 593.210. ALL COSTS FOR GEOTEXTILE FABRIC USED BELOW THE STONE FILL SHALL BE SUBSIDIARY TO ITEM 500.02.
5. TEMPORARY FILLS SHALL BE RESTRICTED TO ONE SIDE OF THE RIVER AT A TIME.
6. AFTER CONSTRUCTION IS COMPLETE, ALL TEMPORARY FILL MATERIAL SHALL BE REMOVED AND THE AREA RETURNED AS NEAR AS PRACTICABLE TO PRE-CONSTRUCTION CONDITIONS AS DIRECTED BY THE ENGINEER.

PERMANENT IMPACTS: 2,370 SF
TEMPORARY IMPACTS: 15,811 SF

TOTAL IMPACTS: 18,181 SF

WETLAND CLASSIFICATION CODES

PUBHh	PALUSTRINE, UNCONSOLIDATED BOTTOM, PERMANENTLY FLOODED, DIKED/IMPOUNDED
R2UBH	RIVERINE, LOWER PERENNIAL, UNCONSOLIDATED BOTTOM, PERMANENTLY FLOODED
PFO4E	PALUSTRINE, FORESTED, NEEDLE-LEAVED EVERGREEN, SEASONALLY FLOODED/SATURATED
PSS1C	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, SEASONALLY FLOODED
PSS1Ud	PALUSTRINE, SCRUB-SHRUB, BROAD-LEAVED DECIDUOUS, UNKNOWN (WATER REGIME), PARTIALLY DRAINED/DITCHED
R4SB6	RIVERINE, INTERMITTENT STREAMBED, ORGANIC
BANK	BANK



LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

- # WETLAND DESIGNATION NUMBER
- # WETLAND IMPACT LOCATION
- # WETLAND MITIGATION AREA
- MITIGATION

REVISIONS AFTER PROPOSAL

NUMBER	DESCRIPTION	STATION	DATE

		DATE
SDR PROCESSED	SEL	1/18/13
NEW DESIGN	AGB	11/2019
SHEET CHECKED	TMC	11/2019
AS BUILT DETAILS		DATE

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 1

Hoyle, Tanner & Associates, Inc.

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879PWT01	15879wetplans	15879	8	12

REVISIONS AFTER PROPOSAL

STATION	DESCRIPTION	NUMBER	DATE

MATCH TO WETLAND IMPACT PLAN 1

n/f
FRY, STANLEY B.
& CHERYL L.

n/f
FRY, STANLEY B.
& CHERYL L.

EXISTING CAROW

SLOPE LIMIT
(TYP.)

LIMIT OF CLEARING
(TYP.)

9
PSS1C

NH Route 101

MC1M

SLOPE LIMIT
(TYP.)

EXISTING CAROW

TEMPORARY
SLOPE EASEMENT

LIMIT OF CLEARING
(TYP.)

3
SCHAAL-GIVEN
CONTRACTING, INC.

10
PF04E

END CONSTRUCTION
STA. 253+50

LEGEND

TYPE OF WETLAND IMPACT	SHADING/ HATCHING
NEW HAMPSHIRE WETLANDS BUREAU (PERMANENT NON-WETLAND)	
NEW HAMPSHIRE WETLANDS BUREAU & ARMY CORP OF ENGINEERS (PERMANENT WETLAND)	
TEMPORARY IMPACTS	

WETLAND DESIGNATION NUMBER

WETLAND IMPACT LOCATION

WETLAND MITIGATION AREA

MITIGATION

SCALE IN FEET: 20 0 20 40

	DATE
SDR PROCESSED SEL	1/18/13
NEW DESIGN AGB	11/2019
SHEET CHECKED TMC	11/2019
AS BUILT DETAILS	DATE

Hoyle, Tanner & Associates, Inc.

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION ∘ BUREAU OF HIGHWAY DESIGN

WETLAND IMPACT PLAN 2

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879PWT02	15879wetplans	15879	9	12

EROSION CONTROL PLAN LEGEND

- PC — PERIMETER CONTROL
  - SILT FENCE
  - EROSION CONTROL MIX BERM
  - EROSION CONTROL MIX SOX
  - TURBIDITY CURTAIN
  - SHEET PILE
  - COFFER DAM
- NB/PC — NATURAL BUFFER/PERIMETER CONTROL
  - SILT FENCE
  - EROSION CONTROL MIX BERM
  - EROSION CONTROL MIX SOX
  - TURBIDITY CURTAIN
  - SHEET PILE
  - COFFER DAM
- CP — CHANNEL PROTECTION
  - STONE CHECK DAMS
  - STRAW WATTLES
  - CHANNEL MATTING
  - CLASS D EROSION STONE
  - CLASS C STONE
- CWB — CLEAN WATER BYPASS
- CWB — PUMP THROUGH PIPE
  - DRAIN THROUGH PIPE OR CHANNEL

WEBB, BRUCE C. & ANN T.

PETERBOROUGH CHAMBER OF COMMERCE

Peterborough Chamber of Commerce

Shell Gas Station

C.N. BROWN COMPANY

FLETCHER & WILDER REALTY, LLC.

LIMIT OF CONSTRUCTION ACCESS

EXISTING CAROW

SLOPE LIMIT (TYP.)

HUMUS & SEED (TYP.)

REMOVE BEACON

NH Route 101

MCTM

15" PE

18" PE

18" CMP

30" CMP

SEE GROVE STREET LOOP DETECTOR DETAIL FOR SIGNAL LOOP LAYOUT

BEGIN APPROACH AT INTERSECTION STA. 238+61.7

People's United Bank

BEGIN CONSTRUCTION STA. 240+00

GRANITE BANK

PJC PETERBOROUGH REALTY, LLC.

Peterborough Plaza

OSJ OF PETERBOROUGH, LLC

MATCH TO EROSION CONTROL PLAN 2

SCALE IN FEET: 20 0 20 40

REVISIONS AFTER PROPOSAL

STATION	DESCRIPTION	NUMBER	DATE

SDR PROCESSED	SEL	DATE 1/18/13
NEW DESIGN	AGB	DATE 11/2019
SHEET CHECKED	TMC	DATE 11/2019
AS BUILT DETAILS		DATE

Hoyle, Tanner & Associates, Inc.

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION ◦ BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 1

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879ER001	15879eroplans	15879	10	12

REVISIONS AFTER PROPOSAL		
NUMBER	DATE	STATION	STATION	DESCRIPTION

SDR PROCESSED	SEL	DATE 1/18/13
NEW DESIGN	AGB	DATE 11/2019
SHEET CHECKED	TMC	DATE 11/2019
AS BUILT DETAILS		DATE

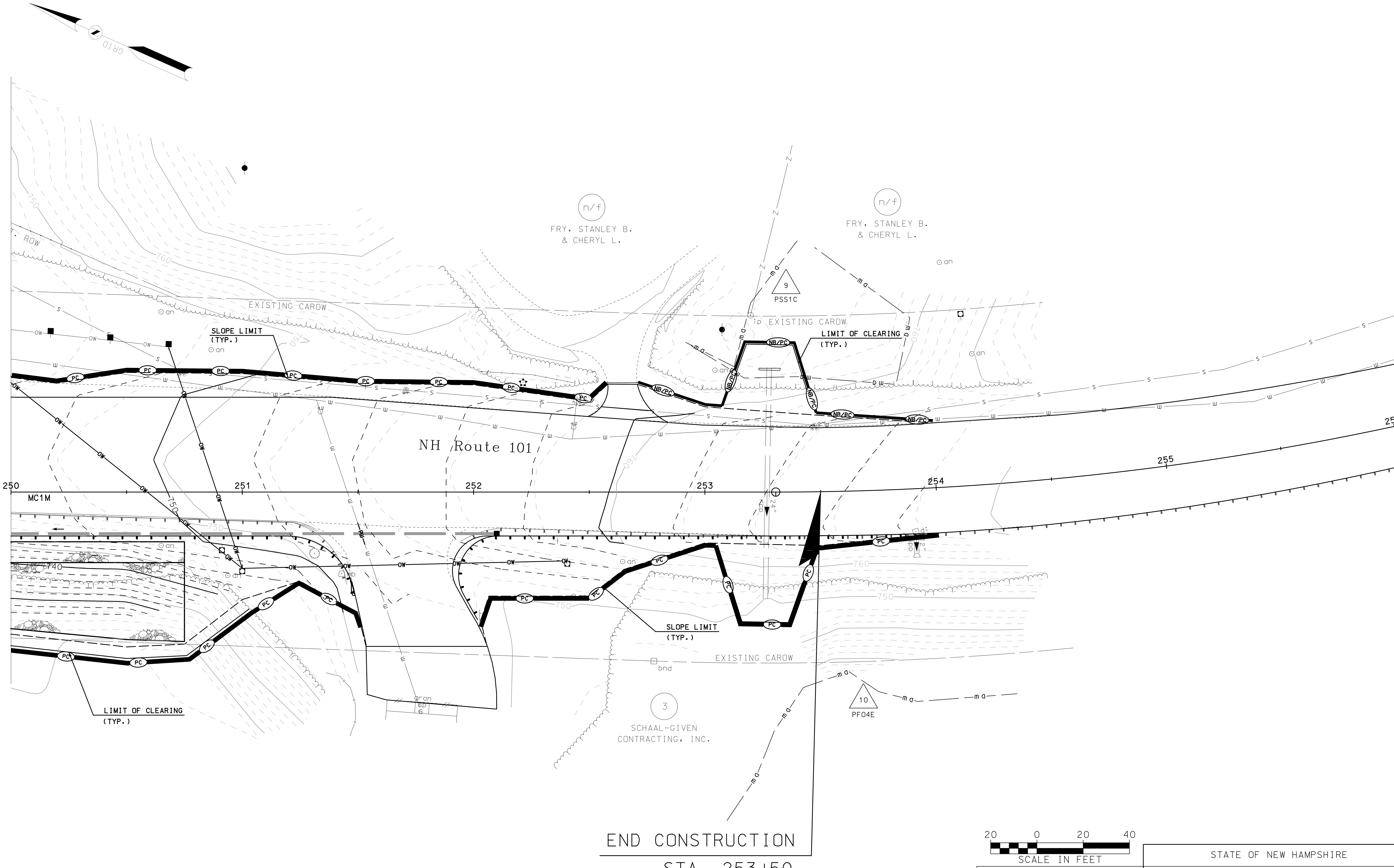
Hoyle, Tanner & Associates, Inc.

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 2

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879ERO02	15879eroplans	15879	11	12



REVISIONS AFTER PROPOSAL			
NUMBER	DATE	STATION	DESCRIPTION

SDR PROCESSED SEL DATE 1/18/13
NEW DESIGN AGB DATE 11/2019
SHEET CHECKED TMC DATE 11/2019
AS BUILT DETAILS DATE

Hoyle, Tanner & Associates, Inc.

STATE OF NEW HAMPSHIRE

DEPARTMENT OF TRANSPORTATION • BUREAU OF HIGHWAY DESIGN

EROSION CONTROL PLAN 3

HTA PROJECT NO.	MODEL	DGN	STATE PROJECT NO.	SHEET NO.	TOTAL SHEETS
092554	15879ER003	15879eroplans	15879	12	12

Attachment P

Hydrologic and Hydraulic Study

US ROUTE 202 & NH ROUTE 101 OVER THE CONTOOCOOK RIVER BRIDGE REPLACEMENT

NHDOT Project No. 15879

PETERBOROUGH, NH

HYDROLOGIC AND HYDRAULIC STUDY
Analysis and Design

Prepared by:
Hoyle, Tanner & Associates, Inc.

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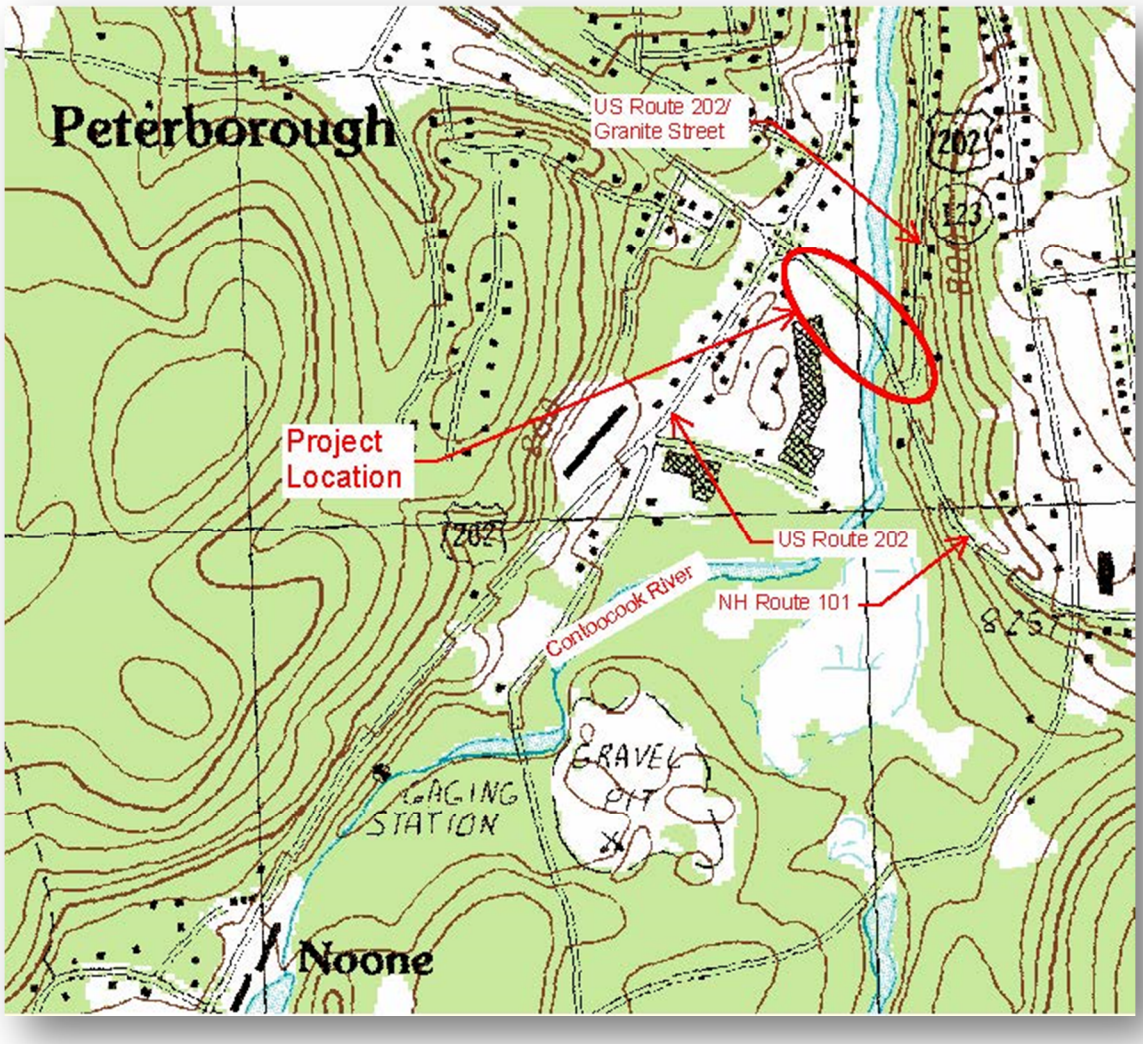
LOCATION MAP



US Route 202 & NH Route 101
Over the Contoocook River

Peterborough, NH

Hoyle, Tanner & Associates, Inc.

1. PROJECT DESCRIPTION

Hoyle, Tanner & Associates, Inc. (Hoyle, Tanner) is currently under contract with the New Hampshire Department of Transportation (NHDOT) for Peterborough 15879, US Route 202 and NH Route 101 over the Contoocook River, for removal of Bridge Number 087/077 from the Red List. The existing piers were expected to remain and be widened to accommodate the proposed 63'-4" wide superstructure. Upon review of available design documents and contract plans during Part A services it was determined the existing substructures were designed for vertical loads only. Upon further review and discussion of the pier analysis methodology and results, pier retrofit concepts, bridge replacement concepts and estimated construction costs with personnel from NHDOT Bureau of Bridge Design, Bureau of Materials and Research and Hoyle, Tanner, it was determined that the bridge should be replaced. The Department's Front Office concurred with changing the project scope from bridge rehabilitation to bridge replacement on March 25, 2013. A 62' bridge, with a reduced skew angle to the roadway, is proposed in the current bridge location.

Approximately 650 linear feet of roadway west of the existing bridge and 700 linear feet east of the bridge are proposed to be reconstructed by removing existing pavement, shimming with crushed gravel and repaving. The proposed condition includes an additional lane which will be constructed by step box widening the south side of the existing roadway. Approximately 325 linear feet of Granite Street is proposed to be reconstructed as well. A sidewalk is proposed along the northern edge of NH Route 101 and the eastern edge of Granite Street. New drainage structures are proposed to upgrade existing drainage within the project limits. A Complete Streets design has been incorporated into the proposed layout. It includes a designated decel lane for NH Route 101 eastbound traffic turning right on to Granite Street, flush painted medians along NH Route 101, and 11' travel lanes with widened shoulders to accommodate bicycles.

2. EXECUTIVE SUMMARY

The project area along NH Route 101/US Route 202 consists of multiple existing closed drainage systems within the project watershed. For the purposes of this report and for efficient analysis of the project, the drainage area has been broken out into ten discharge areas with corresponding discharge points; DP1 through DP10, and NH Route 101 is assumed to run west to east. Discharge points DP4, DP5, and DP10 are eliminated for the post-development condition. This is due to the addition of curbing along NH Route 101 and the removal of scuppers from the proposed bridge. A complete description of each discharge point is discussed in Section 4.

The approach for the project was to capture and treat as much impervious surfaces as possible and to maintain pre-development flows during a 2-year, 10-year, and 50-year storm event at each discharge point. Various BMP's were evaluated at numerous locations (See Appendix E), however due to topography, wetland areas, and soil types, treatment of the additional impervious surfaces could not occur. The current design includes deep sump catch basins for pretreatment and a swale in front of the Peterborough Plaza retaining wall that receives partial treatment. See Table 1 in Section 6 for the existing and proposed flows and drainage areas per discharge point.

3. METHODOLOGY

Hydrology: The pre- and post-development watershed stormwater runoff analysis was completed using criteria and methodologies from the SCS/NRCS TR-20 Methodology. These calculations were performed using HydroCAD® Stormwater Modeling System Version 9.10 software. HydroCAD® is modeled after the TR-20 Method, also known as the SCS Unit Hydrograph Procedure, which utilizes a synthetic rainfall distribution. A Type III rainfall distribution, as developed by NRCS from available National Weather Service duration-frequency data, was utilized for this project. Unit hydrographs were created from rainfall data, drainage areas, times of concentration, and runoff curve numbers and summed to calculate the total runoff for each storm event. This information, for each drainage area, is input into Subcatch nodes. Each drainage area has its own respective Subcatch node.

Storm rainfall data was obtained from the Northeast Regional Climate Center (NRCC) and is as listed below and in Appendix A.

Return Frequency	2 Year Event	10 Year Event	50 Year Event
24 hours	2.91 inches	4.31 inches	6.39 inches

Time of concentration is the time for runoff to travel from the hydraulically most-distant point of the watershed to a point of interest within the watershed. A minimum Time of Concentration of 5 minutes was used for this project. Factors that affect time of concentration are surface roughness, channel shape and flow patterns, and slope. HydroCAD® uses TR-55's methods of sheet flow, shallow concentrated flow, and channel flow to calculate the total time of concentration. A maximum sheet flow length, for each subcatchment, of 135 feet was used for this project.

Weighted runoff curve numbers were determined for each drainage subcatchment area based on the different ground covers and hydrologic soil group types found within each subcatchment. Hydrologic Soil Group (HSG) information was obtained using a National Resource Conservation Service (NRCS) soil map of the site area. The NRCS soil map and soils information are included as Appendix B of the Attachments. Within the project area are 299 soils (Udorthents). These soils do not have a listed HSG designation and are therefore listed as "other" in HydroCAD®. For the selection of curve numbers for the 299 soils, the closest HSG soil type, in plan view, to the 299 soils location was used. It was assumed the soils in the location noted as 299 were taken from nearby and used as fill when the Contoocook River was moved from its original location (where the 299 soils are shown) to its current location (as shown on the plans) and that is why curve numbers from adjacent soils were used for the 299 soils. Below are the curve numbers that were used for various ground covers and hydrologic soils groups.

Ground Cover	HSG A	HSG B	HSG C	HSG D
Meadow (Non-Grazed)	30	58	71	78
Grass	39	61	74	80

Woods	30	55	70	77
Gravel	76	85	89	91
2 Acre Lots 12% Imp.	46	65	77	82
Paved	98	98	98	98

Subcatch nodes are routed to either Reach nodes or Pond nodes. Channels flowing under open-channel conditions are modeled using Reach nodes. Reach routing was performed using the Dynamic Storage-Indication Method. The Dynamic Storage-Indication Method performs the runoff calculations over the entire watershed at each time step. Channel or pipe dimensions, longitudinal slope, and manning's roughness coefficient are input into HydroCAD® which then uses Manning's equation to create the stage-storage and stage-discharge curves that are required to perform an independent hydrograph routing through the channel or pipe. Reach nodes can be routed to other Reach nodes or to Pond nodes.

Pond nodes can be routed to other Pond nodes or Reach nodes. As with Reach routing, Pond routing was performed using the Dynamic Storage-Indication Method, which assumes the storage volume is large in comparison to the inflow. This models the pond as a zero-velocity level pool. Storage areas and outlet devices were input into each Pond node. HydroCAD® calculates a new outflow hydrograph for each Pond node, taking into account tailwater conditions.

For further hydrology information, refer to Appendix C – HydroCAD® Analysis Reports, which contains additional tables, graphs, and computations for the overland flow calculations.

Hydraulics: The proposed drainage improvements have been designed per the *NHDOT Manual on Drainage Design for Highways*, revised April 1998, as well as the *New Hampshire Stormwater Manual Volumes 1-3*, dated December 2008. The drainage systems were modeled using Bentley Systems, Inc.'s InRoads Storm and Sanitary™, XM Edition.

The Modified Rational Method was used to model the stormwater runoff flows as they enter the structures. This is known as overland flow and is a combination of sheet flow, shallow concentrated flow, and channel flow. The Modified Rational Method is similar to the 'Standard' Rational Method except it is used for rainfalls lasting longer than the time of concentration so that peak flow is observed. The 'Standard' Rational Method is based on the theory that the maximum rate of run-off will be achieved when all runoff from a contributing drainage area reaches the outlet. The Modified Rational Method uses the formula Q=CiA; Q is the peak flow (cfs), C is the composite runoff coefficient, i is the rainfall intensity (in/hr), and A is the drainage area (acres).

Runoff Coefficient is the ratio of the rate of runoff to the rate of rainfall at an average intensity when all the drainage area is contributing. If an area has multiple land uses contributing to it, the composite runoff coefficient is the summation of all the areas multiplied by their respective runoff coefficients and then divided by the total area. Runoff Coefficients of various surface types were taken from the *NHDOT Manual* and imported into a format that could be read by Storm and Sanitary™.

Rainfall intensity determines the flow that is expected to drain from an area. It was calculated using Intensity-Duration-Frequency (IDF) curves from the *Weather Bureau Technical Paper 40-*

Rainfall Frequency Atlas of the United States for Durations of 30 minutes to 24 hours and Return Periods from 1 to 100 years. The following Intensity-Duration-Frequency table was used to model storms. This table matches published data for Hillsborough County, New Hampshire.

Storm Duration	2 Year Event	5 Year Event	10 Year Event	50 Year Event
5 minutes	3.70 in/hour	5.00 in/hour	6.00 in/hour	7.60 in/hour
10 minutes	2.90 in/hour	3.95 in/hour	4.60 in/hour	6.00 in/hour
15 minutes	2.45 in/hour	3.35 in/hour	3.85 in/hour	5.00 in/hour
30 minutes	1.70 in/hour	2.30 in/hour	2.65 in/hour	3.45 in/hour
60 minutes	1.15 in/hour	1.50 in/hour	1.75 in/hour	2.30 in/hour

Times of concentrations, as described above, were computed for each catchment area using HydroCAD®. These values were then manually input into Storm and Sanitary™. Storm and Sanitary™ then computes the time of concentration for the complete closed drainage system by choosing the greatest of the following:

1. The longest time of concentration entering a structure from all upstream drainage lines; or

2. The time of concentration from any overland flow entering the structure.

This method is used for all structures in a drainage network until the outlet pipe is reached. For the farthest upstream run, the time of concentration is the inlet time for the overland flow entering the structure.

The proposed drainage system was designed for open channel flow. Storm and Sanitary™ uses the energy-based Standard Step Method when computing the hydraulic profile. This methodology is an iterative procedure that applies Bernoulli's energy equation between downstream and upstream ends of each line in the system. It uses the Manning's equation to determine head losses due to pipe friction. Manning's Roughness Coefficients are from the *NHDOT Manual* and are listed below. Storm and Sanitary™ considers headwater and tailwater conditions while performing a drainage system analysis.

It is the intent of this project to maintain existing flow patterns while improving the closed drainage systems that convey stormwater off the traveled surface and along the road surface.

The following design parameters and criteria were utilized in the design of the system(s):

Closed System Rainfall Event: 10 year
Culvert Rainfall Event: 50 Year
Rainfall Data:
Northeast Regional Climate Center (NRCC): 4.31" (10 Year)
Manning's Roughness Coefficients

Reinforced Concrete Pipe (RCP):	0.013
Corrugated Metal Pipe (CMP):	0.025
Polyethylene Pipe – Smooth Interior (PP):	0.013
Minimum Time of Concentration (Tc):	5 Minutes
Runoff Coefficients	
Pavement:	0.95
Lawns, Sandy Soil, Flat, 2%:	0.07
Lawns, Sandy Soil, Average, 2-7%:	0.12
Lawns, Sandy Soil, Steep 7%:	0.17
Lawns, heavy Soil, Average, 2-7%:	0.20
Minimum Pipe Size	
Pavement:	15 inch
Other:	15 inch
Design Software:	
Hydrology:	HydroCAD® Stormwater Modeling System Version 9.10
Hydraulics:	Bentley Systems, Inc.'s InRoads Storm and Sanitary™, XM Edition

Storm and Sanitary™ uses the principles in the *Urban Drainage Design Manual* (HEC-22) for Inlet and gutter design. Inlets in sump conditions will take the entire flow being routed to it. Inlets in non-sump conditions will take a portion (or all) of the flow being routed to it based on the grate capacity. Flow that cannot be handled by the grate will be routed to a structure downstream as bypass flow. Spread calculations are computed by Storm and Sanitary™ for all inlets and can be found in Appendix G.

A design log report is produced that will summarize each inlets capacity, efficiency, and spread. It will also summarize the capacity, efficiency, and flow through each pipe of the drainage system. If any of these parameters are outside of desired limits, the grate size and/or type and pipe size has been resized to accommodate the incoming flow. For further information refer to Appendix D – Storm and Sanitary™ Closed Storm Drainage Analysis Reports, which contain tables and computations used in the piping system design.

All catch basin frames & grates in this design are based on the *NHDOT Manual* and were modeled within Storm and Sanitary™. Type "B" grates are proposed project wide.

4. EXISTING CONDITIONS

The project site is located along the US Route 202 and NH Route 101 corridor between two intersections; Grove Street where US Route 202 turns south off NH Route 101 and Granite Street where US Route 202 turns north off NH Route 101. For the purpose of this study, NH Route 101 is assumed to run west to east. The project site is a bridge over the Contoocook River which is abutted by a Shell Station north of NH Route 101 and a Shopping Plaza south of NH Route 101 to the west. The intersection with US Route 202 north and a steep slope to a wet area abut the bridge to the east.

NH Route 101/US Route 202 west of the bridge consists of two 12 foot lanes and a 14 foot center turn lane. East of the bridge the roadway consists of two 12 foot lanes, a painted gore area west of the intersection with Granite Street that tapers to zero feet, and a 12 foot right turn lane for westbound traffic to turn onto Granite Street. Granite Street tapers to two 12 foot travel lanes as it extends away from NH Route 101. Shoulder widths along US Route 202/NH Route 101 vary from three feet to eight feet.

The purpose of this study is to evaluate stormwater runoff and the proposed drainage systems. The ultimate receiving water for this project is the Contoocook River. The total watershed area draining through the project is approximately 13.5 acres. Twenty one subcatchment areas were utilized in describing the pre-development (existing) condition. These areas consist of paved, gravel, grassed, residential, and wooded areas. The terrain can generally be described as 3-8% slopes with slopes up to 50% in areas. For the purpose of this study, the project area has been broken up into ten pre-development discharge points, as described below. The discharge points will remain the same in the post-development condition although a few will be eliminated, as discussed below.

Discharge Point 1: Discharge point 1 is located at the western end of the project limits and includes an area of approximately 0.73 acres. It is a 30" R.C. Pipe that conveys the stormwater via a closed drainage system toward the Contoocook River. Discharge Area 1 consists of pavement, woods, and grass. It includes offsite flows from west of the project area; however due to limited survey and no significant change in flow at Discharge Point 1 due to the proposed construction, these offsite flows were not included. Stormwater sheet flows from the roadway pavement and adjacent properties to a closed drainage system that conveys the stormwater to Discharge Point 1. This discharge point will remain the same for the post-development condition.

Discharge Point 2: Discharge Point 2 is located at the outlet of a 12" smooth plastic pipe north of the bridge, along the western river bank. Discharge Area 2 consists of woods and grass and is approximately 0.32 acres. Stormwater sheet flows from the adjacent roadway slopes and grassed slopes around the Shell Station to a low point catch basin that conveys the stormwater to Discharge Point 2. This discharge area and discharge point will remain the same for the post-development condition.

Discharge Point 3: Discharge Point 3 is located at the outlet of a 24" smooth plastic pipe south of the bridge, along the western river bank. Discharge Area 3 encompasses a majority of the project watershed area west of the bridge. It is approximately 1.20 acres and consists of woods, grass, and pavement. Stormwater sheet flows toward the edge of pavement where it is either captured via a roadside ditch line and directed toward the river or it is conveyed via curb at the edge of pavement to an asphalt sluice that directs the stormwater to a grassed swale that flows toward the river. Discharge Point 3 will remain the same for the post-development condition.

Discharge Point 4: Discharge Point 4 is a scupper located on the bridge. Discharge Area 4 conveys water from the bridge pavement directly to the Contoocook River below and is approximately 0.07 acres. The proposed bridge design eliminates this scupper therefore Discharge Point 4 will be eliminated for the post-development condition.

Discharge Point 5: Discharge Point 5 is also a scupper located on the bridge. Like Discharge Point 4, this discharge point conveys stormwater from the bridge pavement directly to the Contoocook River and is approximately 0.11 acres. The proposed bridge design eliminates this scupper therefore Discharge Point 5 will also be eliminated for the post-development condition.

Discharge Point 6: Discharge Point 6 is located at the outlet to a wet area that parallels NH Route 101, south of the bridge, along the eastern river bank. Discharge Area 6 encompasses the majority of the eastbound lane east of the bridge within the project limits. It also includes the grassed and wooded roadway slope down to the previously mentioned wet area. Drop

inlets collect the roadway stormwater and discharge it onto the roadway side slope. The stormwater then continues to flow overland until it reaches the wet area and finally the Contoocook River. Discharge Area 6 is approximately 0.81 acres. Discharge Point 6 will remain the same for the post-development condition.

Discharge Point 7: Discharge Point 7 is located north of the bridge, approximately 65 feet inland from the eastern river bank. Discharge Area 7 is the largest discharge area and includes approximately 10 acres of grass, pavement, residential, and wooded terrain. It includes the portion of Granite Street (US Route 202) within the project limits and the steep slope east of Granite Street. The slope east of Granite Street is collected via ditch lines and conveyed under Granite Street by an 18" Smooth Plastic Pipe. This pipe outlets to a ditch line that conveys the stormwater to Discharge Point 7. Stormwater from Granite Street sheet flows to catch basins along the curb lines and outlets west of Granite Street toward Discharge Point 7. Discharge Area 7 is approximately 10.11 acres. This discharge point will remain the same for the post-development condition.

Discharge Point 8: Discharge Point 8 is located at the outlet of a 12" Smooth Plastic Pipe at approximate proposed roadway station 254+00, RT. Stormwater from approximately 50' of the EB shoulder of NH Route 101 is collected via a catch basin and outlet at Discharge Point 8. This is a small discharge area of approximately 0.01 acres and will remain the same in the post-development condition.

Discharge Point 9: Discharge Point 9 is located on the northern edge of pavement, across from Discharge Point 8. Stormwater from Discharge Area 9 sheet flows off the paved roadway surface therefore there is no single discharge point for Discharge Area 9. This discharge area of approximately 0.11 acres and discharge point will remain the same in the post-development condition.

Discharge Point 10: Discharge Point 10 is located along the southern edge of pavement approximately 135 feet west of Discharge Point 8. As with Discharge Area 9, Discharge Area 10 does not have a single discharge point. Stormwater sheet flows offsite from the paved roadway surface. The proposed southern edge of pavement in this area will be curbed in the post-development condition therefore the stormwater from NH Route 101 will be collected by a catch basin that will then convey the stormwater toward Discharge Point 6. Discharge Point 10 will be eliminated in the post-development condition. Discharge Area 10 has an approximate area of 0.06 acres.

The pre-development flow areas for all discharge points were modeled using HydroCAD® as described in Section 3. Routing was performed for the 2, 10, and 50 year storm events and peak runoffs were determined. See Table 1 in Section 6 for runoff flows and drainage areas by discharge point.

5. PROPOSED CONDITIONS

The proposed drainage improvements for this project have been designed per the "NHDOT Manual on Drainage Design for Highways (2015)" as well as the "New Hampshire Stormwater Manual" and make use of Best Management Practices with curbs, storm drainage pipes, stone outlet protection, and deep sump catch basins for pretreatment. As feasible, existing ditch lines were maintained to maintain stormwater flow directions. Minimum cover over drainage pipes of 4' was met for most of the closed drainage systems, however less than 4' is provided over the culvert under the plaza drive. A stronger R.C. Pipe was used to account for less cover.

Reinforced concrete (R.C.) pipes are proposed under pavement areas while plastic pipes are proposed elsewhere.

The discharge points have not changed from the pre-development condition; however three have been eliminated as discussed in section 4. The discharge points that have been eliminated are Discharge Points 4, 5, and 10. This is due to proposed curb redirecting the stormwater to different discharge points. Discharge Points 4 and 5 are redirected toward Discharge Point 3 in the post-development condition and Discharge Point 10 is redirected toward Discharge Point 6. The post-development Discharge Area 3 is approximately 1.49 acres and the post-development Discharge Area 6 is approximately 0.87 acres.

The post-development flow areas were modeled using HydroCAD® as described in Section 3. Routing was performed for the 2, 10, and 50 year storm events and peak runoffs were determined. See Table 1 in Section 6 for runoff flows and drainage areas by discharge point.

As shown in Table 1 there are increases to the post-development outflows for Discharge Points 3 and 6 for all storm events; 2, 10, and 50. These increases are due to the additional roadway runoff from the eliminated discharge points and the additional approximately 0.25 acres of impervious area. It is believed the increase in flow to Discharge Point 3 will have minimal effects on the Contoocook River downstream. Stone outlet protection will help dissipate any additional outlet velocity that may occur due to the increase in flows. It is also believed the increase in flow to Discharge Point 6 will have minimal effects on downstream areas. Stone outlet protection at the outlets to drainage pipes within Discharge Area 6 are expected to dissipate any additional velocities that may result from the additional flows.

Deep sump catch basins are proposed within the roadway for pretreatment. Ground water recharge volume requirements cannot be met due to the poor soil conditions. Previous design included an infiltrating catch basin in the Granite Street median island, however once geotechnical information was received it was concluded the soils would not infiltrate as originally thought. A swale is proposed in front of the retaining wall by the Peterborough Plaza. Due to site constraints it is not long enough to meet criteria to classify it as a treatment swale, however it will provide some treatment of the stormwater. Calculations are included in Appendix E.

6. SUMMARY

This report demonstrates that the proposed 62' bridge along NH Route 101/US Route 202 will have minimal impacts when comparing pre- vs. post-development outflows. As previously stated, there will be minor increases in peak flow at Discharge Points 3 and 6 during all storm events; 2, 10, and 50. This is due to the addition of curbing along a portion of NH Route 101 and the elimination of scuppers on the bridge. Hoyle, Tanner believes these increases will have minimal effects on the Contoocook River and downstream properties. Table 1 below summaries peak runoffs and drainage areas per discharge point for pre- and post-development conditions.

Table 1 – Existing and Proposed Flows

FLOWS (CFS)								
	2 Year		10 Year		50 Year		Area (Ac)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Discharge Point 1	0.59	0.59	1.22	1.22	2.24	2.25	0.730	0.740
Discharge Point 2	0.04	0.04	0.22	0.22	0.61	0.61	0.320	0.320
Discharge Point 3	1.25	1.90	2.35	3.13	4.12	4.97	1.204	1.491
Discharge Point 4	0.20	-	0.30	-	0.44	-	0.070	-
Discharge Point 5	0.31	-	0.47	-	0.69	-	0.110	-
Discharge Point 6	0.68	1.38	1.19	2.33	2.23	3.84	0.810	0.860
Discharge Point 7	1.18	1.13	3.99	3.50	11.92	11.50	10.110	10.070
Discharge Point 8	0.03	0.03	0.04	0.04	0.06	0.06	0.010	0.010
Discharge Point 9	0.31	0.31	0.47	0.47	0.69	0.69	0.110	0.110
Discharge Point 10	0.17	-	0.25	-	0.38	-	0.060	-
						TOTAL	**13.534**	**13.601**

Notes:

1. Pre-development Discharge Points 4 and 5 flow into the post-development Discharge Point 3.
2. Pre-development Discharge Point 10 flows into the post-development Discharge Point 6
3. There is an increase in flow at Discharge Points 3 and 6 due to the additional curb and pavement added in the proposed condition.

Appendix A
NRCC Rainfall Data

Appendix B
NRCS Soil Map

Appendix C
HydroCAD Analysis Reports

Pre HydroCAD

Post HydroCAD

Appendix D
Storm & Sanitary Closed Storm Drainage Analysis Reports

Appendix E
BMP Calculations

Appendix F
Groundwater Recharge Volume Calculations

Appendix G
Spread Calculations

Appendix H
Stone Outlet Protection Calculations

Appendix I
Catch Basin Sizing Calculations

Appendix J
Existing Conditions
Subcatchment Areas

Appendix K
Proposed Conditions
Subcatchment Areas

Hoyle, Tanner & Associates, Inc.

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